



4th Edition.

Practical Chapters

— ON —

Static Electricity.

BY

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*Author of "A New Static Interrupted Current," "Static Electricity in Cutaneous Affections,"
"Static Electricity in the Treatment of Writer's Cramp and the Occupation Neuroses,"
"An Improved Upright Portable Faradic Apparatus, with Voltage Scale for
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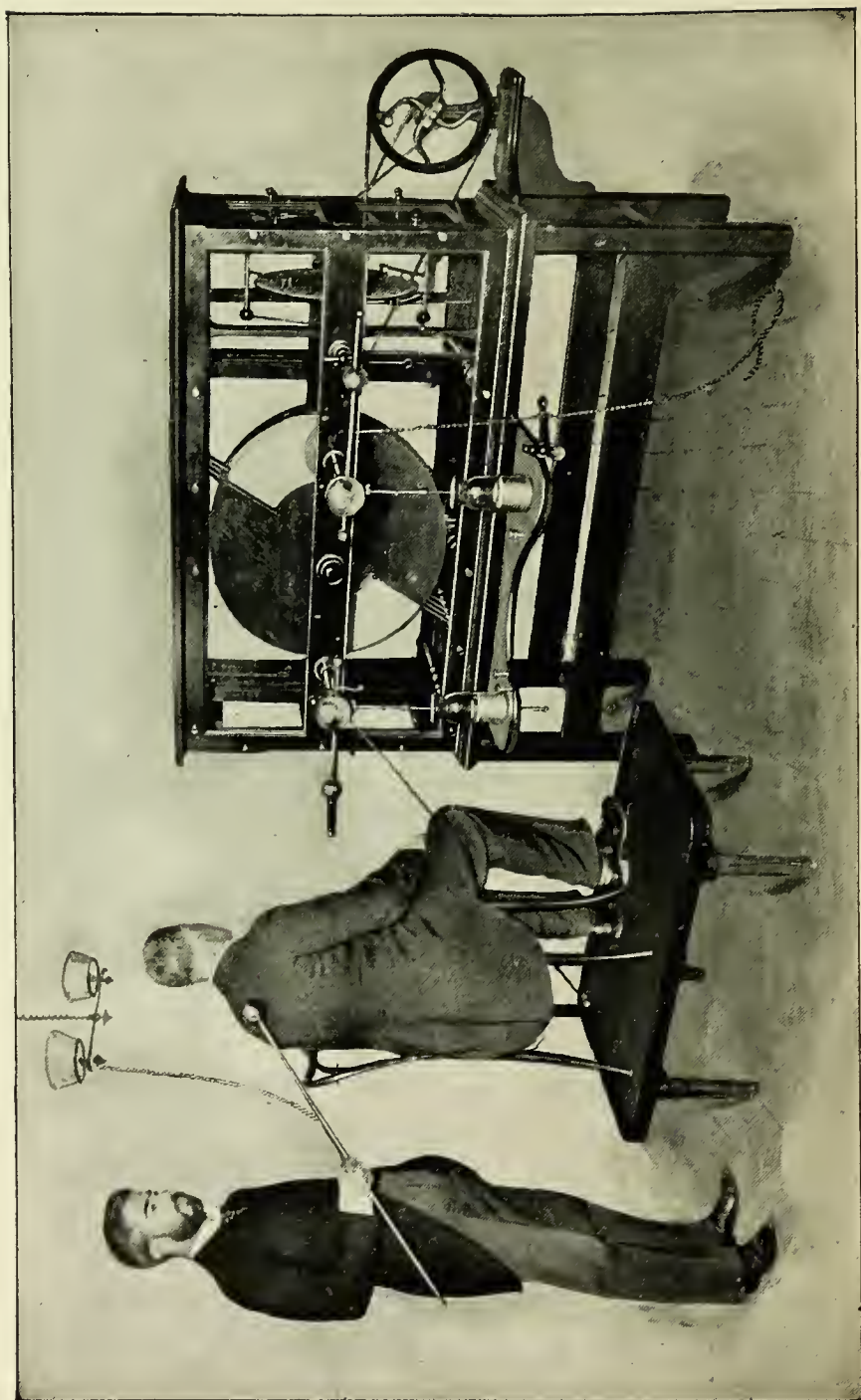
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THE MORTON-WIMSHURST-HOLTZ INFLUENCE MACHINE.



WHAT IS THE TRUE STATUS OF STATIC ELECTRICITY IN MODERN MEDICAL LITERATURE?

THE static electrical machine is now to be found in the offices of many physicians throughout the United States, and its use is not alone confined to specialists and sanitariums. As it becomes improved and better known it is more frequently employed, and each improvement in its construction marks a new step toward a popular career. Notwithstanding its antiquity as a medical agent, it seems to be but now upon the threshold of its real introduction to the medical profession at large.

The galvanic and faradic currents have been extensively written upon, but the static current has not. It occupies a field peculiarly its own, in which it is unique. It is an ally, rather than a competitor, of other forms of electricity, and it constitutes another link in our chain of resources. When galvanism and faradism have either given negative results or have lost apparently for a time their remedial power when their use has been too long continued, the static form will often be found to possess a decided advantage, and will greatly aid us in accelerating results. In this it renders the medical electrician a valuable service, and adds another string to his bow. In many cases, where another current may be commonly used, static will be preferred by all at whose command it is, for two reasons: (1) It is often more easily applied; (2) it is often more speedily effective. Some of its work is done with astonishing facility; so much so as to lead to over-confidence in its powers. When it has failed, it has been correspondingly over-abused; so that half the profession do not know what value to attach to it. These contradictions and disputes about it are scattered through medical text books, and the reader who consults his library alone to find out the therapeutic worth of static electricity has a perplexing task before him.

For the purpose, therefore, of untangling the maze of conflicting and bewildering statements that serve to confuse this subject, I have gathered together a number of extracts taken from various sources, and shall present them in such a manner that every physician who reads this chapter can form a competent judgment for himself. As has been said before, the literature of static electricity is exceedingly meager, but medical writings have been ransacked by me to obtain both sides of the case. No attempt at chronological order has been made, but the authority for each extract will be fully given. *

Quain's "Dictionary of Medicine," 1888, article on "Electricity," by G. V. Poore, eight and one-half columns in length, dismisses static in thirty-six words, as follows:

* Compiled in 1894.

"Franklinic electricity, which is generated by the friction of glass disks or cylinders, which was formerly in vogue, has now become nearly obsolete in therapeutics and need not detain us in an article like the present."

"Electro-Therapeutics," by Wilhelm Erb, M. D., 1887, is a volume of 726 pages and about 275,000 words. It contains but three brief references to static electricity :

1. "The invention of the frictional machine facilitated the use of this agent, yet, though largely employed, we do not see that the results amounted to much."

2. "Many attempts have been made, and at various periods, to utilize frictional or static electricity in therapeutics, but they have (even those most recently made in Paris) not had such results as to secure for static electricity a certain position in this connection. We need not therefore speak of this form of electricity, which, moreover, obeys the same fundamental laws which govern the other forms."

3. "Static electricity has been employed in Paris, not without effect (Charcot, Vigoroux), for all hysterical symptoms as well as for the actual disease itself."

The last of these is printed as a foot-note, and the balance of this great work is devoted to galvanism and faradism. The immense disproportion between the space accorded these and the brief references to static illustrates the extreme oblivion to which the latter has been relegated by prominent authors. Duchenne, who has been entitled the father of modern electro-therapeutics, affirms that :

"Static electricity affects neither the internal organs, nor the pulse, nor the secretions, nor the intellectual functions, nor the respiration ; and that it is to-day abandoned, its therapeutic value being as little appreciable as its physiological action."

In the two large and learned volumes on "Localized Electrification," Dr. Duchenne devotes scarcely four pages to static electricity, but Arthuis ingeniously remarks upon this "that, as every word is an error, he has done well to be so reserved." Nevertheless, Duchenne says further along :

"It is assuredly incontestible that static electricity, which for so many years was used exclusively in practical medicine, has accomplished cures bordering on the marvelous. Static electricity has cured chorea and a large number of nervous and paralytic affections."

Dr. Tripier says, in his "Manual of Electro-Therapy," 1861 :

"Static electricity offers resources too much neglected in our day. There is in it, in the electric bath, the electrification by needles, the soufflé, that which cannot be supplied by any equivalent procedure, and before being banished from therapeutics an experimental study should be again entered into to learn its effects."

In 1850 Dr. Wilks writes in the Guy's Hospital Reports this observation, from his experience :

"After the introduction of electro-magnetism or faradism, static electricity fell into disuse, but I feel confident that it was not successfully superseded by the new agent."

The authorities for the succeeding group of extracts are given in each instance :

1. "The modified Holtz, or Toepler-Holtz, electrical machine is now used to procure all of the nerve and muscular effects hitherto obtained by faradic electricity, and also therapeutic results of a very striking kind."—*Bartholow's "Materia Medica,"* 1890, p. 430.

2. "For many years after the discoveries of Galvani and Volta static electricity still remained in exclusive possession of the field of electro-therapeutics. The number of accessories required, the expense and cumbersomeness of the machines, and the unpleasant shocks employed as its chief mode of administration have prevented its frequent use in the treatment of disease; but no electrical department of a hospital would be complete unless it were provided with an apparatus for the treatment of patients by static electricity."—"Medical Electricity," by Stevenson and Jones, 1892, p. 86.

"Considered from every standpoint, a successfully operated and powerful static machine is, without doubt, the most surprising single therapeutic weapon in the whole arsenal of scientific medicine."—"A Brief Synopsis of the Therapeutics of Static Electricity," by S. H. Monell, M. D., *New York Medical Journal*, January 20, 1894.

"There are many pathological conditions in which frictional electricity is to be preferred to the other modifications."—Wells' "Electrotherapy," 1869, p. 159.

"It will be observed that little mention is made of static electricity. This is because its use is practically debarred the general practitioner by the expense of the machines and difficulty of managing them, and because its use in my own hands has not been followed by better results than that of faradism, which is simpler of application and accessible."—"Practical Electro-Therapeutics," by W. F. Hutchinson, A. M., M. D., 1888, *Preface*.

"The static spark was even less useful—in fact, I have of late discarded it as a pain-killer, believing that in a majority of cases, no matter how skillfully handled, it is as apt to aggravate as to relieve."—"Electrical Anæsthesia," by Dr. W. F. Hutchinson, 1892, p. 12.

"In this agent we possess one of the greatest stimulants to metabolism. It is doubtful whether either of the other forms of this force can compare with static electricity as a metabolite. Without doubt static electricity is the ideal cutaneous stimulant."—Plym. S. Hayes, M. D., "Electricity in Diseases of the Skin," p. H. 11. *Int. System of E. T.*, 1894.

"Static electricity often gives successful results in the treatment of motor as well as sensory symptoms. Of late years this variety has been much used, and in a great measure has superseded the galvanic and faradic currents in the treatment of neuroses, largely because of the convenience with which it can be applied, and its adaptability to a variety of different conditions."—"Neuroses," by Morton Prince, M. D., p. K. 40. *Int. System of E. T.*

"A form of electricity still higher in tension and lower in quantity than the faradic current is the static or franklinic electricity. This, after having almost fallen into oblivion, has recently been resuscitated as an agent of great value."—"Electricity in Diseases of Childhood," by Mary Putnam Jacobi, M. D. *Int. System of E. T.*, 1894, p. Q. 25.

The *Medical Record*, April 6, 1889, reports a discussion on "the place of electricity in therapeutics," at the Academy of Medicine, March 21, 1889, in which Dr. M. Allen Starr said:

"It seems strange how much credence was still given static electricity in therapeutics, for its action was limited exclusively to the surface of the body charged; it did not penetrate the skin, could not permanently charge the body, and could produce a curative effect only as a surface irritant, or by reflex action, which effect could be obtained equally well by faradism or by massage, lomi-lomi, whipping by twigs," etc.

Dr. Starr closed with the following statements:

"Static electricity offered nothing more than the interrupted galvanic, and failed to furnish those effects which were most desirable in the treatment of disease. . . ."

Dr. L. C. Gray said:

"He had no faith in static electricity. The two currents which would answer every purpose of the physician were the galvanic and faradic."

Dr. E. D. Fisher said:

"Undoubtedly galvanism was more important as a remedial agent in nervous functional diseases than was static or faradic electricity; yet in regard to static he would say that in his

opinion it should not be so positively discarded as it had been by Dr. Starr. Especially in neurasthenic cases did it have a stimulating and pleasing effect. It was in functional diseases, with error in nutrition, and not organic troubles that static electricity found its field of usefulness."

Dr. A. H. Smith

" . . . had obtained marked and immediate benefit from static electricity, as he could do from no other form in soreness and stiffness of the wrists and other joints, due to exposure to cold."

A convincing reply to Dr. Starr's paper by Dr. W. J. Morton appeared in the *Medical Record*, May 31, 1890. The entire paper, excellent as it is, is too long to republish here, but in it the author says :

" He was struck by its merits and efficiency as exhibited at Professor Charcot's clinic in Paris in 1880, . . . the therapeutic use of static electricity has extended enormously in medical practice. . . Dr. Starr's entire structure based upon the static charge falls to the ground. . . I believe that no form of electricity penetrates more deeply than the static ; and premising a powerful machine, a powerful spark, a conservative expectation as to results, a fair comparison with galvanism and faradism, an intelligent selection of cases, and a fair amount of skill in administration, I believe that no other form of electricity equals it in curative effects."

The following extracts are taken from the Guy's Hospital reports of the years given below :

" As a last resource I determined upon giving [static] electricity a fair trial. The effect produced by it at once gratified and surprised me and led to further trial, the results and particulars of which will not, I trust, be deemed altogether unworthy of the profession. Certain it is that although I had often ordered it myself and more frequently witnessed its employment by others, I never for a moment entertained the belief that it possessed the power over the disorders alluded to that I am now inclined to concede to it."—*Dr. Addison*, 1837.

" So many discrepant statements exist in the records of medicine regarding the action of [static] electricity, as an agent in the treatment of disease, that scarcely any general opinion can be drawn regarding its real influence. In the hands of some it has appeared to possess an almost magical action in the most intractable diseases ; while others equally worthy of confidence have declared it to be utterly worthless. [After describing the manner in which case records were kept in the electrical room under his own supervision, and reporting the results in about one hundred cases, Dr. Bird goes on to say :] In the remarks contained in this paper and from the cases detailed, I venture to hope that I have adduced a sufficient amount of evidence to demonstrate that [static] electricity, though possessing no specific or magic influence over any particular disease or class of diseases, is yet really capable, when judiciously applied, of producing marked effects ; and although it fails to produce the wonderful results ascribed to it by empirics, is nevertheless capable of becoming an important aid in the treatment of disease."—*Golding Bird, A. M., M. D., F. L. S., etc.*, 1841.

" The effects of [static] electricity in chorea are sometimes very remarkable. On some occasions I have known it to effect a cure after a great variety of other remedies had for weeks and months been tried in vain. When the body has been wasting, the mind apparently giving way, and the disease proceeding unchecked if not increasing, notwithstanding a variety of remedies employed assiduously and for a long time, electricity has under my own observation and direction effected a really marvelous change. The disease has in fact been cured and the effects of the disease upon the health and appearance have ceased. When electricity acts beneficially in chorea it produces its effects more rapidly than any other remedy with which I am acquainted, but it is a remedy which is not of universal application in chorea."—*H. M. Hughes M. D.*, 1846.

"The remarkable and, in some instances, astonishing results obtained by [static] electricity in chorea would seem to warrant the assumption of some direct controlling power in the electrical force over the nervous system, but these are probably in part explicable by the known action of this stimulus upon the tissues. . . It is in hemiplegia and paraplegia, depending upon the direct influence of cold or arising from atony and hysteria, that [static] electricity is of the greatest value. In these cases it is inestimable."—*William Gull, M. D., 1853.*

The above but faintly represents the sound observations and extensive clinical records made by these members of Guy's Hospital staff, but lack of space prevents any longer extracts from this interesting source.

"To my mind too little importance and too small space is given to the consideration of static electricity and too little is said of its value as a curative agent. It is with a growing conviction of its worth as a therapeutic agent, and its right to equality of rank with the other currents, that I seek to bring it more prominently before you."—"Static Electricity as a Therapeutic Agent," by F. E. Caldwell, M. D., *Journal of Electro-Therapeutics*, 1893.

"I have been struck in many instances with the rapidity with which it effected an apparent cure, in other cases with the permanency of its beneficial results; and in all with the simplicity and ease of its application. To a lady, for example, it is a matter of no small moment that she is free from the necessity of divesting herself of any garments worn, and that almost any part of the body can be treated without exposure and annoyance. To the busy practitioner also to whom time is valuable, it is not unimportant that no delays are caused by waiting for each patient to remove and replace their clothing. As a curative agent I regard static electricity as of great value. Static electricity is to-day, for the second time, generally recognized by the profession as a valuable therapeutic agent. It is steadily regaining the popularity it so justly achieved in the eighteenth century."—"Static Electricity in Medicine," by A. L. Ranney, M. D., *The Physician and Surgeon*, 1887.

I will next quote from three different editorials in the *Journal of Electro-Therapeutics* for different years:

1. "In examining the reports of static electricity and its action upon disease conditions I have been unable to find any person who possesses one of the later improved machines, capable of producing a good volume of electricity amid all the changes of the atmosphere, but that believes that it has a special sphere of action which is possessed by no other agent known to him. . . That static electricity affects such deep parts of the body as the interior of large joints, the ovaries, and deep-seated muscles, when diseased, thousands of cases on record from good and reliable observers prove to be a fact. As regards the objection that it is not capable of producing any effects that the galvanic and faradic currents are not, we might theorize extensively here to prove that it differs from either of the other forms of electricity; but as practical results are always better than theory, we will say that we could, if time permitted, report a few cases which had thorough trials of both galvanic and faradic electricity without effect, and which were cured with a very few applications of static electricity. The reports of hundreds of cases, by physicians all over the world, entirely coincide with this view."—*April, 1890.*

2. "We have been very much surprised to find that there are so many static machines in use. . . When we come to consider the question of static electricity fairly, I think we must conclude that it holds an important place in electro-therapeutics, the exact position of which is not quite so well understood as are the galvanic and faradic currents, and therefore needs all the more to be carefully studied, observations correctly recorded, and unprejudiced writers to put it before the profession."—*July, 1893.*

3. "In conclusion I would say that my honest conviction is, after treating a large number of cases with electricity, that the static form is of far greater value than faradism, and at least as useful, if not more so, than galvanism."—*July, 1894.*

These statements bear evidence of careful consideration, and the four years covered by the dates of publication seem to have only convinced the author more and more of the merits of static electricity. Our next extract recalls the manner of Erb and Poore :

"The chief interest in electro-therapeutics has heretofore centered about the galvanic and faradic currents, although the value of the static current in cases adapted to its use is unquestioned. I have made much use of the last-named current during the last ten or twelve years, but consider its value so small and its application so limited, when compared with the indispensable utility of the galvanic and induced currents, that I shall devote no space to its consideration."—" *A Discussion of the Electro-Therapeutic Methods of Apostoli and Others*," by J. H. Kellogg, M. D., *Int. System of E. T.*, 1894, p. G. 54.

In files of the *Medical Record* will be found a report of a meeting of the Practitioners' Society, May 2, 1884. A paper upon "The Treatment of Sciatica by the Strong Galvanic Current" was read by Dr. V. P. Gibney. In the discussion Dr. W. J. Morton

"... knew of scarcely any disease which he had treated more frequently, or which had given him more trouble in treating satisfactorily, than sciatica. He agreed with Dr. Gibney concerning the special form of treatment. . . He had great confidence in counter-irritation. . . . As to treatment by electricity, he had been in the habit of using the faradic current in rheumatic cases in the shape of a brush. He had used static electricity, but would not think of treating the acute cases by this method. . . He did not see any special advantage in the use of static electricity in the treatment of sciatica."

The next quotations are from a different source :

"... it is not my purpose to enter into any discussion of the limitations to or the indications for the use of faradism, of galvanism, or of static electricity. I have used all of them, but have been disappointed in the results obtained from the latter. In this I know I shall not be supported by many who are present. But here again *a priori* considerations may have swayed me into not using it often, and also the fact that the test cases in which I applied it were the contractures secondary in hemiplegia, where faithful applications during several weeks made no change whatever."—" *The Sphere of Usefulness of Electricity in Nervous Diseases*," by Joseph T. O'Connor, M. D., Ph. D., *Journal of Electro-Therapeutics*, December, 1893.

"I have made use of static induction in ovarian pain, neuralgic, or even due to cystic ovaries, prolapsed ovaries, or salpingitis, and I have never had it fail to give surcease from suffering. . . We are just enough emerged from primitive darkness to realize that static electricity will eventually play a leading rôle in therapeutics. . . I know of but few diseases in which static electricity may not be used. As a gynecological electro-therapeutist I owe it much, for there be complications and anomalous conundrums that try the patience, and static electricity is balm to the irritated soul."—" *Static Electricity as a Therapeutic Agent*," by Horatio R. Bigelow, M. D., 1893.

"Adams states that 'in all vaso-motor disturbances, functional cerebro-spinal diseases, or neuroses, there is nothing in the author's experience which equals in value the diffuse and the concentrated constant high potential current from electro-static induction machines.'"—" *Materia Medica and Therapeutics*," Shoemaker, 1893, Vol. I., p. 145.

"I regard static electricity as a most valuable addition to our armamentarium. No one who expects to meet the demands of all the varying idiosyncrasies of the nervous system can afford to be deficient in the completeness of his electrical outfit. Static electrification possesses nutritive and tonic properties of a high order, and in certain conditions one may even succeed in obtaining results after unsuccessful attempts with dynamic electricity.

"Ideas will of course differ as to which of the various manifestations of electricity are the

most efficient therapeutically, according to the character and extent of one's experience. After many years of observation and comparative trial, my own judgment is that the dynamic forms of electricity properly utilized (and I emphasize this point because far more care and detail are called for than in the use of static electricity), occupy a wider field of therapeutic usefulness than the static form; but each form has its special uses and adaptations, and all are indispensable to him who makes much use of electricity in medicine."—*A. D. Rockwell, M. D., Letter to Author, February 15, 1895.*

How shall these conflicting statements be reconciled? For unless it can be shown that one side or the other is worthy of our confidence we can form no true opinion of the merits of the case. Static electricity has been long enough in use to test and ascertain its therapeutic action. It has been before the profession longer than the iodides, bromides, cod-liver oil, and other remedies now well known. In fact it antedates scientific pharmacy altogether. Although the early machines were inferior to modern ones, yet static electricity did active service in a few hands upward of five generations ago. It flourished to a great height of prosperity for fifty years, relapsed into a singular oblivion, again emerged from it, slowly advanced into limited favor, and finds its brilliant reputation of a past century now obscured by a maze of contradictory literature so confusing to the reader that it requires something of an expert to perceive the truth. In grouping these opposite views together one noticeable fact is made clear, viz., that the advocates of static speak from a large personal experience with it, while those who denounce it have generally had little or none whatever. Let us now glance over the unfavorable assertions we have cited, and mark "how plain a tale shall put them down." It will be found that no argument on my part will be necessary, for, singular to relate, they all fall to pieces at the slightest touch, like a house of cards.

G. V. Poore's comment refers to inferior and antiquated *friction* machines, which, in the damp climate of England, of which he writes, were operated at a great disadvantage. In the drier climate of the United States our modern and powerful *induction* (not merely frictional) machines are far more satisfactory; and as no drug would be condemned because an inferior preparation of it failed, so it is not reasonable to denounce a given form of a useful agent like electricity because a certain type of machine, which is now obsolete and was long ago superseded by a better one, did not produce a sufficient dose for general usage.

Professor Erbs' remarks appear to be those of a man who sees through a glass darkly, and who evidently does not intend to see the light. His third statement refutes the preceding two, and all three are manifestly second-hand information; it being plainly apparent that this classic writer does not speak from personal knowledge based upon competent experience. He is therefore not a qualified witness.

Dr. Duchenne's assertions are, on their face, ridiculous, and can be so demonstrated by any physician who will test a personal application of static electricity for fifteen minutes. Moreover, he destroys his own case by his later admission that "it performs cures bordering on the marvelous,

and has cured chorea and a large number of nervous and paralytic affections."

Dr. W. F. Hutchinson is the next detractor. In the extract dated 1888 he relegates this form of electricity to the attic. In his 1892 paper he "discarded it as a pain killer, as it was as apt to aggravate as to relieve." Poore, Erb, and Duchenne may be accused of being behind the age of our new machines, but here is a prominent American author, nearly up to date (1892), who also has a poor opinion of static. How shall we dispose of his assertions? By his own testimony! In a New York medical journal for *November, 1892*, Dr. Hutchinson himself described a new static machine of the Wimshurst type, which he had recently purchased, and among his approving statements I quote the following:

"The new machine has certainly done its part. In driving rain, with open windows close by, or in clear sunshine, it goes steadily about its work, and I have had no annoyance from dampness. It is worth knowing that the static electricity is no longer out of reach of anyone who chooses to employ it, and that its use is now free from the annoyances that caused experts to abandon it."

This certainly disproves his previous derogatory remarks. Place also Dr. Hutchinson's 1888 statement by the side of Dr. A. L. Ranney's of 1887, and compare. We next reach Dr. Starr's somewhat celebrated proclamation that static electricity "acts only as a surface irritant, after the fashion of lomi-lomi, whipping with twigs, etc." This dictum was put into imperishable print six years ago, but it became obsolete almost as soon as printed, if the story told the writer is correct.

I am informed that shortly afterward Dr. Starr was invited to step upon a static platform by a brother physician, who had read the article, and who applied a few sparks to the doctor's biceps, triceps, quadriceps, etc. The sparks spoke for themselves, and the discussion ceased, as Dr. Starr gracefully said he "would take it all back." Dr. J. H. Kellogg's strictures come next. He also furnishes us the material to refute his first remarks.

"Dr. J. H. Kellogg stated that he had employed a small machine for many years. Later he had obtained a larger one, which he had used with better results. He, however, did not formerly regard static electricity with much favor. Within a year or so he had had a powerful machine made for him with six plates of forty-five inches' diameter, and he was now much better satisfied with static electricity. In fact he was pleased with it, and got four times as good results from it as formerly. He found its effects very marked. The excretion of $C. O_2$ was increased during the static charge. He recognized the value of increasing the power of the current."—*Discussion on Static Machines at the Fourth Annual Meeting of the American Electro-Therapeutic Association, September 27, 1894. Reported in "Times and Register."*

The next report to notice is one from a very unexpected source—Dr. W. J. Morton. In his comments upon Dr. Gibney's paper of May 2, 1884, he appears opposed to the use of static in sciatica. Other views of Dr. Morton's in this paper prove that he needs no defense from charges of being unfavorable to static electricity, but his statement of 1884 is in print, and could no doubt be quoted to day by any writer upon the subject.

It might be repeated in good faith and with no attempt at unfairness, but that it would not represent his present opinion may be made evident by citing his part in a later discussion of the treatment of neuralgia reported in the *Post-Graduate*, April, 1893:

"Dr. Morton said a neuritis may be 'pounded' by the static spark, or submitted to a powerful static induced current, and it will cease to ache for a certain length of time after the first treatment, and this interval gradually lengthens until relief is permanent. He knew of *no other method* which accomplished the same result. . . He believed that neuralgia could ordinarily be cured in a much shorter time by this treatment than by the methods usually employed. While his remarks had been particularly directed to the consideration of *sciatica*, they applied equally well to all other forms of neuralgia and neuritis. He had seen no case of neuritis so sensitive that he would not treat it actively by static electricity." (Results of ten cases were here cited by Dr. Morton.)

This is a precise and complete statement, and no one who reads it can attach present importance to the remarks of 1884.

Immediately following the extract above disposed of, we find the brief mention of static by Dr. J. T. O'Connor. It is probable that the doctor would object to have his skill in the use of a static machine estimated by the evidence he here gives. If "*a priori* considerations" have swayed him "*into not using it often*," how, then, can he be a competent judge of its effects? A hungry man who would be "swayed" by "*a priori* considerations" into not testing the efficacy of a beefsteak, would hardly be an authority on the value of beefsteak in certain cases.

We thus see that most of our unfavorable extracts are refuted by the men who wrote them. The extent to which this is true is not a little remarkable, but, unfortunately, these erroneous statements once turned loose in print pursue their devious way, and although they may be called back or contradicted by their authors, they cannot be altogether inoculated against doing more or less harm. Many will happen to read them who may never see the retractions, and they are quoted and repeated by other writers who have little appreciation of the facts.* These refuted extracts which I have gathered together here, to illustrate the influence of the press against static electricity, are the irresponsible flotsam and jetsam of static literature. They float about among medical writings to unsettle the judgment of the inquiring reader, who, in search of truth, encounters instead these fallacious and

* An instance of this character came to my notice almost as the above words were written. An article designed for publication in a medical journal was sent to me for my editorial approval, with a note in which the writer stated that it was "the result of his readings." In the opening paragraph he narrates that "static electricity expends itself mostly on the surface of the body and does not penetrate, so it has but little direct effect on the deeper structures." Yet he goes on to say that it "is useful in chronic gout, rheumatism, dyspepsia, and insomnia, neuralgia, writer's cramp, neurasthenia, functional aphonia, chorea, and other nervous affections."

As not one of these troublesome diseases is an affection of the skin, it would seem that the incongruity between the statement that static electricity expends itself on the surface of the body and that it cures such non-cutaneous diseases as dyspepsia, gout, and chorea, would strike every intelligent physician, even while he was copying the paragraph.

abandoned fragments, which now, like derelicts at sea, should be run down and sunk into oblivion forever.

But it is natural for a physician to ask why mention of static electricity is so nearly absent from all general text-books upon the practice of medicine and surgery, if it possesses the properties that are claimed for it.

The answer to this question is no doubt to be sought in more directions than one. The long neglect of mechanical ingenuity to so improve the apparatus that it would readily work under all circumstances was a bar to its general use. Moreover, little has been done until recently to make known to the great body of physicians the place it justly fills in therapeutics. Scarcely a college, hospital, or dispensary in the United States has possessed a reliable static machine and taught its clinical applications to disease. Teachers and text-books have alike ignored it almost completely. There is not a single modern book devoted exclusively to this subject to be found in print to-day.* I am, however, convinced that the extraordinary properties of frictional electricity would have obtained a widespread recognition from medical teachers, had inventive skill and enterprise not slumbered over the machine that generated it. No single drug, and no other form of electrical force, received equal attention from the earliest and greatest of experimental philosophers. During half a century it occupied alone the whole field of electro-therapeutics. But the crude types of apparatus were too imperfect for ordinary use, and no one improved them. Then static electricity fell into neglect, became chiefly a laboratory wonder, astonished admiring students by its disruptive discharge and accompanying phenomena, but played a small part in relieving the sufferings of humanity. Something has been done, however, in a few instances and at wide intervals of time, to demonstrate the value of this therapeutic agent; but the reports of the results have been so ignored by general medical literature, and have been given so little modern currency among physicians, that they contribute practically nothing toward enlightening the profession. I presume that not more than a dozen physicians now living have even read the full reports of Addison, Bird, and Gull. Letters continually coming to me indicate that physicians in general do not know where to obtain literature upon static electricity, and I am not aware that any such collection as this of published opinions on the subject has ever before been made.

If this presentation of a much disputed case serves to place the matter in an impartial light the object of this paper will be accomplished.

* Since writing this statement the author has furnished the medical profession with two standard text-books entitled **MANUAL OF STATIC ELECTRICITY IN X-RAY AND THERAPEUTIC USES, AND THE TREATMENT OF DISEASE BY ELECTRIC CURRENTS.**

A CONSIDERATION OF THE STATIC MACHINE AS DISTINGUISHED FROM STATIC ELECTRICITY.

A POINT too commonly lost sight of, in weighing criticisms of electricity as a therapeutic agent, is that the battery or machine that produces any form of this force is not the agent—the electrical force—itself. Many criticisms, that would apply perfectly if the given machine was the product of itself, are obviously inappropriate to the product of newer, larger, and more powerful machines of vastly superior therapeutic usefulness. Machinery of all kinds has been improved. Our galvanic batteries surpass Volta's pile, our faradic batteries are better than Faraday ever saw, our magazine rifles have taken the place of old flint-lock muskets, steam engines and steamships have outgrown the early models, and the static machine of to-day is a great improvement upon the inventions of Ramsden, Nairne, Van Marum, and even Holtz. I believe that it will serve a useful purpose to devote a short chapter to the consideration of static machines as contra-distinguished from static electricity.

A physician unfamiliar with static electricity, but witnessing the performance of a splendidly handled and powerful machine, would be amazed to read the statements by well-known authors declaring static electricity a "failure." Such strictures would seem irreconcilable with the evidence of his eyes; but however incredible he might regard them in the presence of a superbly powerful apparatus, they are perfectly credible if we apply them to an inferior machine under unfavorable conditions. No cripple is more helpless than a static machine without its electrical charge. It is absolutely useless. It is more aggravating than an inert preparation of ergot or an insoluble cathartic pill. It is like an empty rifle. Without a proper *charge* the rifle and the Holtz machine are equally inoperative, and, moreover, both equally require a directing skill in order to accomplish results. It has been this defect, more than all other causes combined, that has delayed the general employment of static machines.

For upward of a century the types of apparatus made were variously inadequate, but for the past ten years we have had a type of satisfactory power, provided that it remained charged. When it discharged in unfavorable weather it was often so difficult to recharge that few could endure the annoyance without complaint. The means employed to restore the lost charge was usually the friction of a piece of catskin upon the revolving plates. Anyone who has tried this on a damp day in August needs no further explanation why static electricity was "abandoned by experts." When static electricity abandons your static machine day after day, and refuses to be wooed back with seductive catskins, nine men out of ten would abandon static electricity also until the supply was placed on a more permanent basis.

With this fact in view, I do not hesitate to say that the pivotal improvement for which confidence in static electricity has waited has been a ready-

means to keep the static machine charged. This needed improvement has arrived, and is to be found in the Morton-Wimshurst-Holtz Influence machines manufactured during the past year by Van Houten and Ten Broeck of this city. That there may be just ground of complaint against some static machines, even now, must be apparent when we consider that many of those in the hands of physicians are either old, or have too few and too small plates, or have got out of order from neglect. A certain amount of care is required to keep any piece of machinery in proper working condition. If a static apparatus is allowed to stand neglected and exposed to atmospheric changes, invaded by its twin enemies dust and damp, its bright parts tarnished and corroded, its wood parts warped, its electrodes, conductors, and platform covered with a film of dirt, its internal adjustment deranged, and operated, if at all, by an indifferent assistant without either mechanical aptitude or special experience, no one should wonder if the results are disappointing.

It sometimes also happens that poor results are obtained under apparently excellent conditions, or conditions which a non-expert could not readily believe to be unfavorable. A case in point may be cited, to illustrate the importance of understanding the facts before shifting the blame from the operator and the machine to static electricity itself. A prominent specialist in electro-therapeutics, after twenty years' experience with galvanic and faradic batteries, procured a Holtz machine. It happened to be in the early summer when it was placed in his office. During the summer it gradually gave out a feebler and feebler current, was discharged nearly every day, rattled when revolved, its combs scraped against the plates, and it was generally disappointing to its very able owner. As the physician in question had never had any thorough instruction in the care and management of the machine, he could see no reason why it failed to work. An expert examination however at once disclosed the facts :

This physician habitually kept his office windows open throughout the summer, regardless of fog, mist, or rain. The chloride of calcium in the case was saturated with moisture and had been damp when it was first put in. The poles were left in close proximity, and the machine usually discharged itself every night. On this account he had opened the end doors every day with windows still open, rain or shine, while he laid siege to the inner plates with the tedious and uncertain catskin. When in operation, the machine was so situated that the platform was almost directly under the prime conductors, and the outer edge of it was separated but a few inches from his office desk. These conditions were all bad, yet to a general observer it would seem incredible that, in so fine an office and in the hands of a renowned medical electrician, a new and superior static machine could behave so poorly. Skillful as the doctor was in his familiar work, he had made no attempt to prepare himself to skillfully manage the new apparatus he had purchased, and such a state of affairs has no doubt furnished the ground for many adverse criticisms against static electricity. However, the combs were set right, the chloride baked dry in the oven, the various parts cleaned and

adjusted, and the machine was then recharged. Directions were given to keep the doors of the case tightly closed, the poles separated and the groundings taken off when not in use, and the external parts kept free from dust and damp. It is needless to say that a great improvement took place in the performance of this machine. Had the apparatus been furnished with the miniature charger now supplied, and had the doctor but taken ordinary care to keep the case dry, he could have used his machine every day in the year with very little trouble and very great satisfaction.

So closely allied to the therapeutic consideration of static electricity is the question of the cost of the static machine, that it is proper to refer briefly to the business aspect of the case and dispel one illusion that exists. It is occasionally affirmed that the expense involved places static electricity entirely beyond the reach of any practitioner except the financially fortunate specialist or a wealthy sanitarium. Let us see how far this is true. Innumerable physicians make liberal expenditures in their office equipment, in costly cabinet batteries, in instruments, microscopes, and scientific apparatus of various sorts, as well as in artistic furniture and extensive libraries. Large numbers of the profession own a horse and cart, and not a few maintain showy equipages at great expense. There are probably in general family use more than a million pianos, organs, etc., many thousands of which are in the homes of ordinary physicians. Few of the costly articles that are so readily sold as those I have mentioned are money-makers. The static machine is. Its cost is only about that of a fairly good horse and vehicle, which a doctor would buy without being censured for extravagance.

Surgical instruments, laboratory appliances, horses, carts, and even office and household furniture all require continuous care and some outlay of money to maintain in excellence. With similar care and little or no annual outlay, the improved static machine may be kept in full working order with an unfailing charge. It would be difficult, if not impossible, to name any other single implement in the equipment of a physician's office which will annually do more to demonstrate his professional skill, to establish and enhance his success, enlarge his resources, and also to enable him to cope easily with that difficult class of neurotic cases which go all the rounds of the *materia medica* and resist the effects of every form of treatment until they gracefully surrender to static electricity. With recent improvements in apparatus, it has now reached a stage of development where its reliability and effectiveness more than warrant its becoming as widely known, as generally employed, as favorably accepted, and as thoroughly recognized and appreciated as any form of modern medical electricity. Ignorance of its merits should no longer find any excuse; the ancient delusion that it acts on the surface only should be dropped, and skepticism as to its actual value in medicine should give place to impartial tests of its capabilities. To the extent that the static machine is limited in its use, and to the extent to which the successful physician omits to include this powerful agent in the practical resources with which he combats disease, it appears that he deprives himself of a superior advantage which he would otherwise possess. As a bene-

factor of humanity in general, and of its owner and operator in particular, there is probably no therapeutical apparatus which surpasses the machine we have been considering.

In closing this article it may be well to refer to a practical point of interest, viz., the tendency to *reverse* its charge exhibited by all Holtz machines. It is convenient to know how to remedy this occurrence. In the *Medical Record*, February 24, 1894, I described the method, which, so far as known to me, had not previously been discovered. The title of my article was, "A New and Original Method of Correcting the 'Reverse' of the Positive Static Charge, with Further Practical Suggestions." To those who refer to this method I would say that it always suffices with my own machine, and I have simplified it by now merely lifting the positive end of the case and jarring it several times upon the floor. The *jar* accomplishes the result when the other conditions are fulfilled.*

I cannot better conclude this subject than by quoting an observation from a "Treatise on Frictional Electricity," by Sir William Snow Harris, F. R. S.: "*It should ever be borne in mind that the best instrument does the best work under the guidance of the best hand.*"

*At the time the above sentence was written I had a six-plate twenty-six inch machine which could be lifted. Since then all my machines have developed into ten-plate thirty-inch sizes, which, of course, are much heavier, and I do not lift them. The *reverse* is, however, accomplished on the principles set forth in my article. My remarks on page 11 have been cited by a foreign writer to prove that the American Holtz machine was a great deal of trouble. I therefore state that an average attention of less than five minutes per day keeps my static machine in working order every day in the year. Physicians who wish to duplicate my results may obtain instruction by attending my clinic.

A simpler and more direct method of shifting static polarity I now teach as follows: Cleanse the lacquer from the brass rod which projects out of a medium size Leyden jar and fix on it a permanent hook of stiff copper wire. When desiring to transpose the positive charge from one pole to the other, draw the sliding poles wide apart, hook the single Leyden jar on either pole and revolve the plates rapidly till the jar is charged. Then stop the plates and quickly lift off the jar by carefully grasping the edge of the wooden top between the thumb and second finger of the left hand in such a way as not to leak off the current. With the right hand quickly give the plates a few turns backward to discharge the parts within the case, and the instant the plates stop touch each prime conductor with a grounded chain till the remnant of spark ceases. At once hook the jar on the opposite pole and start the machine into action. Push the sliding poles near together at the same time so as to tell instantly which is now positive. If the jar was not charged the attempt will fail. If the machine discharges and gives out no current at the final stop, simply connect one pole with the Wimshurst charger without stopping the Holtz plates and give the Wimshurst a few rapid turns till the charge appears. The result is usually the one sought. A little practice makes it very simple. If, however, a first attempt entirely fails, it takes but a moment to repeat. The whole process needs quick handling and I have demonstrated *four* complete changes of polarity to a student in ten minutes to illustrate the technique. If the conditions are such that the reversed charge persists despite more than one attempt to correct it, the machine can be used till a more convenient time when a second application of the method is apt to succeed at once.

S. H. MONELL.

THE PHYSIOLOGICAL ACTION OF STATIC ELECTRICITY IN ITS VARIOUS FORMS OF APPLICATION.

ENDOWED with high potential, and extremely deficient in volume, the physiological effects of static electricity are chiefly modifications of the ordinary vital processes without electrolytic alterations. Static electricity may increase, diminish, arrest, or otherwise modify these functional processes. It affects secretion, excretion, absorption, reflex action, sleep, respiration, circulation, and nutrition. Owing to its enormous E. M. F. and its power of condensation and accumulation, it possesses great diffusiveness, which enables it to affect the entire system in a limited degree.

That static electricity had a decided influence upon the physiological functions is not a discovery of our own times, but was observed before galvanism and faradism were dreamed of. In a work written previous to 1790 we read the following remarks on this subject :

“Electricity, strongly communicated to insulated animal bodies, quickens their pulse and promotes their perspiration. If it is communicated to insulated fruits, fluids, and in general to every kind of bodies that are actually in a state of evaporation, it also increases that evaporation, and that in a greater or less degree according as those bodies are more or less subject to evaporate of themselves, or as the vessels that contain them are conductors or non-conductors and as they have a greater or less surface exposed to the open air.”

In 1777 and 1781 there were published in London editions of a treatise on medical electricity, by Tiberius Cavallo, in which are recorded all that was known in his time of the subject in hand. The discerning observations here quoted were made at least ten years before the first foreshadowing of Galvani's discovery of a current with chemical and electrolytic properties ; and they are not only remarkable for their accuracy, but for the fact that little has been added to them since. Mr. Cavallo recites as follows :

“The remarks made by philosophers relating to the effects of [static] electricity upon the human body in general, are the following, viz., that by electrization, whether positive or negative, the pulse of a person is quickened, the number of pulsations being generally increased about one-sixth ; and that glandular secretions and the insensible perspiration are promoted and often restored when they have been entirely obstructed. It might naturally be suspected that the promotion of perspiration and of glandular secretion was only the consequence of the accelerated pulse and not the immediate effect of electricity ; but the contrary is easily proved by observing that in various cases the quickening of the pulse by other means, as fear, exercise, etc., does not promote those secretions nearly so much, if at all, as electrization, and also the glandular secretions and perspiration are often promoted by electricity when applied only to a particular part of the body, in which case it seldom, if ever, accelerates the pulse. Hitherto it has not been discovered that [static] electricity acts within the human body by any chemical property, as most medicines generally do ; but its action by which it produces the above-mentioned effects may be considered merely as a mechanical stimulation, for it seems to act as such even within those parts of the body which, especially when diseased, are mostly out of the reach of other remedies. . . . From these observations it appears that the application of [static] electricity does not merely promote any discharge or circulation of fluids, but rather assists the *vis vitæ*, or that *innate endeavor* by which nature tends to restore the sound state. It may, perhaps, be ever difficult to explain in what manner electricity

assists that natural endeavor, but experience shows the certainty of the fact, and with it we must be gratefully content; for we may apply the effects to our wants, though we may be ignorant of their cause and mode of action.

"When an electric shock is sent through any part of the body, an instantaneous involuntary motion is occasioned, which shows that the muscular fibers through which the shock is sent are expanded or in some other manner convulsed. This involuntary motion is also occasioned by sparks. Farther, when a shock is sent through several substances besides the human body, a tremulous motion and an expansion is evidently occasioned, as may be shown by many experiments. Now all these observations may perhaps in a manner explain the action of electricity upon the organized parts of an animal body by comparing it with the tremulous motion given to tubes of any sort through which fluids are transmitted, in order to accelerate their passage or prevent any stoppage or stagnation which might occur.

"In my essay upon Medical Electricity it is mentioned that from the experience of many it appeared that electrization increases the number of pulsations about one-sixth; but having made many experiments upon myself, I added the following observation in the second edition of my essay in the year 1781, and consequently long before Mr. Van Marum's experiments: 'I do not remember that my pulse was ever evidently accelerated by electrization, and yet I have tested the matter at various times and with great diversity of circumstances. In another essay I have stated that by repeated experiments, accurately made by Mr. Van Marum and other ingenious persons, it was found that electrization, whether positive or negative, did neither sensibly augment or diminish the natural pulse rate in a healthy man. Upon the whole, therefore, it seems to be ascertained that electrization does not increase or retard the ordinary number of pulsations, and the increase generally observed before may have been due to fear or apprehension. But I am now informed by Mr. Partington, who has long practiced medical electricity, that electrization, if not in a sound, at least in an unsound state of the body, augments the number of pulsations considerably.'

About a hundred years later a French writer, Dr. A. Arthuis (1871), summed up the physiological effects of static electricity as follows:

"It induces an acceleration of the pulse, it is singularly *calmant*, eases the respiration, develops animal heat, augments cutaneous transpiration, makes more active the urinary secretion, disperses nervous irritation, and gives tone to the whole organism. It is the great dispenser of equilibrium to the disturbed balance of the system, it increases the vital forces, and augments the energy of absorption. In a word, it excites and facilitates the play of all the functions. It is regarded by those who use it as the greatest regulator of menstruation. The well-being which it instantaneously produces causes those who have once experienced it to wish for a repetition of its beneficent effects."

When, 140 years ago, it was discovered by the Abbé Menon that the human body loses weight by being continuously electrified for five or six hours, he attributed the loss to the increase of insensible perspiration and tissue change. We now say about the same thing in somewhat different language. The teachings of modern investigation upon this subject may be fairly stated in the following terms: "Static electricity increases the excretion of urea, and lessens the uric acid in the system by promoting oxidation. It increases both the appetite and the body weight when the latter has been reduced by impaired nutrition. It lowers the blood pressure. In ten to fifteen minutes of general electrification, or a few minutes of sparks to the spine, a gentle perspiration ensues, accompanied by a feeling of well-being. When this reaction has been reached the sitting may be ended for the day, in ordinary treatment. Under the influence of static electricity, the heart-beats undergo a change, viz., if slow, they may increase ten to twenty beats

per minute ; or, if too fast, they may be reduced in number. It tends to regulate functionally deranged temperature. Many cases of neurotic, neurasthenic, and melancholic conditions are found to have subnormal temperatures (97° to $97\frac{1}{2}^{\circ}$) before electrification. These states it adjusts to normal, and the patients then usually improve.

The static spark causes groups of muscles to jump. It is a most powerful stimulus to nerve and muscle function, and rapidly imparts tonicity, lightness, buoyancy, and firmness to soft, lax, and enfeebled muscular substance. It first causes a vasomotor constriction, blanching the skin. This soon gives place to a dilatation, and the spot gets red. Frequently a weal is raised, with a temporary sense of tingling and irritation, which will quickly pass away or be instantly removed by rubbing the part with a little toilet powder. If sparks are applied with sufficient persistence to the same area, a mild papular eruption will often be caused.

Devoid as it is of electrolytic action, the power of static electricity seems to be chiefly manifested as a regulator of *functions*. It tends to adjust to normal action the heart, respiration, pulse, temperature, oxidation, secretion, excretion, nervous irritability, and sleep. It increases metabolism so that a person can absorb more oxygen : and this mere improvement in nutrition is a vast power for good, and alone suffices to correct many morbid states ; as gout, rheumatism, neurasthenia, neuralgia, anæmia, and various symptomatic derangements.

The spark, by its powerful mechanical disturbance, sets up a great molecular change and acts as a stimulating massage. It thus affects the nutrition of a part, disperses exudation material, and promotes absorption. Thickenings of joints, tendons, and muscles, localized œdemas, effusions, etc., are reduced by strong, thick static sparks. With fine, rapid frictional sparks may be obtained the beneficial effects of counter-irritation upon the skin ; and with a special electrode a blister may be created in from one to four minutes, if desired. Sedative or stimulating effects are equally under the operator's control, and may be obtained at will. Many varieties of pain are promptly relieved by some form of static electricity ; and, if not due to an incurable or persisting cause, it is well-nigh certain that the pain-killing property of this agent will give permanent relief, if treatment is persevered in long enough.

As a concluding summary of modern opinion upon the action of static currents, I will repeat here an abstract of the report of the committee on "Standard Electrostatic or Influence Machines" presented to the late convention of the American Electro-Therapeutic Association, and published in the *Times and Register*, December 29, 1894.

"The chairman of the committee stated that the report was one of immense comprehensiveness and could only be scratched on the surface in the short time allotted him. The physiological effects of static electricity are pretty much all that are produced by all electricity. It sets free the potential energy of the cells of the human organism. That is, it excites the cell in such a way that its inherent energy is liberated. Its wide range of effects vary with and depend somewhat upon the manner in which it is applied. It causes contrac-

tion of the protoplasm, both animal and vegetable. It excites nerve fibers, nerve cells, and nerve centers. All of them are excited to functional action, and caused to produce their separate effects—motor, sensory, special sense, secretory, sympathetic, vasomotor, etc. It has a mechanical action. It disturbs the molecular arrangement of tissues and causes a new structural arrangement, resulting in modifications of nutrition.

"It has a cataphoric action and can be made to transfer metals and convey medicaments into the tissues. Its general effects are of great range and astonishing importance. They may be briefly stated as follows: It promotes nutrition of every part it excites; produces marked local and general circulatory effects, and stimulates the vasomotor nervous system. It promotes metabolism and tissue metamorphoses; creates a feeling of refreshment to the system; causes the reabsorption of exudation material of a chronic nature and has a revulsive action upon the skin. It is both a cutaneous sedative and counter-irritant, and makes a powerful peripheral impression of great value in neurasthenia.

"The subject of reflex pains is of constant interest to a physician. Pains are often referred by patients to points distant from their origin. Possibly a pain travels along the path of least possible resistance, and in its outward path it prepares the way for the return of a curative influence along the same path. No matter how far from the local irritation a reflected pain may manifest itself, spark the sore place and the impression will track the pain to its seat and drive it out. We can't cure altered structure, but we can correct functional pains, and often relieve organic pains, by setting up powerful ingoing impressions and displacing the pain.

"The list of diseases in which static electricity can be beneficially employed is a long one. Its great fields are nervous and functional conditions. In cases of mal-nutrition it is an excellent tonic. Neurasthenia, hysteria, neuralgia, nervous headaches, etc., are rapidly controlled by it. In cord diseases it affords relief from various forms of pain, even when lesions are advanced beyond cure. It is invaluable in muscular rheumatism, chronic synovitis, and chorea. It is one of the best general tonics we possess, and as such is easy and agreeable of application, and can be used in a great variety of cases. In the treatment of paralysis of curable forms it is one of the most successful agents we have."

It should be noted, however, for the better understanding of those who are not practical electricians, that these interesting effects attributed to static electricity are neither invariable nor absolute, but depend upon and are influenced by concomitant conditions just as drug action varies under different circumstances. For instance, in a cold office, and with a patient with habitually cold extremities and lack of vital warmth, we will discover little sign of the perspiration spoken of. It may therefore be stated that the demonstrable physiological effects upon any given case will be modified by the individual idiosyncrasy of the patient, the apparel worn, the state of atmosphere in the room, the electrical output of the machine, the method by which it is applied, and the duration of the sitting. The great electro-motive force of this current gives it almost unlimited power of penetration, accumulation, and diffusion. When the machine is in action and we interrupt the continuity of the output by a series of sparks anywhere upon the conductor, every particle of atmosphere in the room is thrown into vibration, and the same vibration is set up in the tissues of the patient. A person now seated upon the platform may feel with his extended hand the atmospheric commotion synchronous with the passage of each spark, and the person's hair, if sufficiently long, will exhibit the same oscillations to an observer. If we imagine every nerve fiber and blood vessel in the electrified

subject undergoing the same intense oscillatory stress, we can readily understand one aspect of its effect upon circulation and nutrition.

It was formerly the fashion to call in question the penetrating capacity of the static current and to claim that its action is limited to the surface of the patient's body. It is curious to see how such a contradiction became so deeply rooted in the literature of electro-therapeutics, for a very simple argument will prove the reverse. This argument may take several forms, of which it is sufficient to present one, viz.: It is not claimed that galvanic and faradic currents pass only on the surface of the body between two applied electrodes. It has long been admitted that they both penetrate into the tissues beneath the skin. The resistance of the air, however, is so infinitely greater than that of the skin that neither galvanic nor faradic medical currents will pass between two conductors separated by an air space of an inch or any appreciable portion of an inch. Now, it is well known that the static discharge will pass through several inches of atmospheric resistance; and if a patient be seated upon a platform at the usual distance from a Holtz machine, but without any conducting attachment to it, he will be sufficiently electrified to yield a perceptible spark. I have frequently measured the distance at which the breeze from a point electrode can be felt, and found it to be upward of forty inches. Metallic bodies, thirty or more feet removed from an operating machine, are influenced.

After witnessing this exhibition of a power of overcoming resistance so enormously surpassing the power of either current which admittedly penetrates within the human body, the theory of surface limitation is difficult to maintain. A rifle bullet that will pierce steel armor will hardly be stopped by a wooden shingle.

In concluding these observations upon physiological effects, it may be of service to some who become interested in reading further upon the subject to state that a "A Brief Synopsis of the Therapeutics of Static Electricity," by the present writer, was published in the *New York Medical Journal* for January 20, 1894.

STATIC ELECTRICITY: METHODS OF ADMINISTRATION.

THIS subject, usually passed briefly over in most writings upon static electricity, may fairly be considered of great importance to the therapist, and it is my purpose to treat the matter more fully than has yet been done in any article or book that has so far come to my notice.

Physicians accustomed to the administration of electric currents created by chemical action are apt to be somewhat confused when they first attempt the application of static electricity. In both galvanic and faradic administrations, the patient is placed in a circuit closed and made operative by the sensible contact of two moist or metallic electrodes with the surface of the body or its cavities.

Similar methods, indeed, are pursued in employing the Leyden jar induction current obtained from the static machine, but in general the method of applying static electricity is in marked contrast to these.

Instead of placing certain tissues or portions of the patient's body between two electrodes, and affecting chiefly or only the included parts, and employing a current with a direct circuit flow and little or no lateral dispersion, we transform our entire patient into one great electrode by seating him upon the insulated terminus of the active pole of the machine.

The other pole is usually connected with the earth and may be wholly disregarded in general treatment. When the machine is started into action, a separation of the collected electricity into positive and negative takes place. Each dissociated portion of the electric force, being self-repellent, strives to escape from the inclosing case of the machine by a separate channel, and the result is a continuous flow from the higher to the lower potential. The flow from one-half of the revolving glass plates is carried off to the earth by the chain attached for this purpose to the unused conductor, while that from the opposite half of the plates is conveyed by a conducting rod or chain to the insulated platform, where its downward flow is headed off and a remarkable phenomenon takes place. Unable to pass down the glass supports of the platform to reach the great negative magnet the earth, the swift output of the machine *accumulates* like a fast rising flood, escaping upward and outward at every point where the tension of insulation gives way. The accumulation from a powerful machine is thus sufficient to form a great electric pool upon the platform, in which the patient is invisibly bathed, becoming electrified with the same potential as the prime conductor to which he is attached; and he is charged everywhere alike throughout every tissue, filament and fiber of his body, for it is a law in electrics that "the potential inside a conductor has the same value as at any point on its surface."

There is no clothing to remove, no current direction (ascending or descending) to take into account, and no rheostat is required to govern the current strength.

The individual upon the platform is simply permeated from foot to head,

not with a galvanic streak shot through him from point to point, but by an electric force of illimitable dispersive power, and a penetrating energy that laughs at the resistance of the human tissues.

Without *accumulation* there could be no therapeutic employment of static electricity, owing to the small quantity of the current stream. To illustrate this we may stand the patient upon the floor instead of the insulated stool, and place the hand upon the conductor as before.

The current now flows through the body to the earth at its normal rate of strength (quantity), but no crackling sound is heard as it escapes, no hair stands erect upon the head, and the spark from the largest ball electrode is so small and feeble that, to obtain it, the electrode must be held within about half an inch of contact. Various tests of this kind may be made by each operator for himself, and by personal experimentation alone can the physician become intelligently familiar with every phase of action of the static machine.

With these preliminary remarks I shall now attempt to describe the various methods of administration.

Of the usual electrodes furnished with machines two are of paramount importance, viz., the point and ball. The chief routine methods of application are three, viz., electrification, breeze, and sparks.

In addition, this form of electricity may be employed in a greater variety of ways by an expert than both the galvanic and faradic currents combined. It will be difficult to describe them all in a limited paper, but it may be stated in general that in static administrations no nicety of skill is wasted. Practice, intuitive perception of what each case requires, discriminating judgment, gentleness, caution, tact, and trained mechanical adroitness will all be found of the utmost value in contributing to satisfactory results. Let us select a series of cases for treatment and illustrate the methods we may employ. Before admitting our patient we have first inspected the machine, ascertained that it is charged and in working order. We now place the platform in position in front of the machine and about two feet removed from it. The platform is then attached to the selected prime conductor of our apparatus by means of the rod furnished for this purpose, or, if we so desire, by means of a chain, wire, or any metallic connection. The opposite pole is now grounded, to conduct away the unused potential and establish the current flow. In most cases the negative pole is grounded, as we usually desire to electrify the patient positively.* An ordinary chair or stool is now placed upon the platform. It may be any form of wooden, cane, leather, or upholstered chair (rocker, reclining, or otherwise), but must be devoid of all metallic ornamentation, such as fancy-headed nails around the seat. We have now only to ask our patient to step upon the platform and sit down. We see that her dress does not drag upon the floor at any point, to leak off the current, and we are ready to start the machine into action. The plates revolve, a slight crackling sound is heard as the current issues forth, accumulates, and escapes; and complete electrification is shown by the loose hairs on the patient's head, which stand tensely out in all directions. The

* This refers only to general electrification without local treatment

insulated person is agreeably conscious of the electric charge, but experiences no marked sensations. We may subject her to this simplest form of treatment for fifteen or twenty minutes, and find that it is an admirable and restful tonic, and that the tenderest infant could not complain that it was unpleasant. It is the foundation and starting point of all static treatment.

But suppose it is the summer season and the day is damp, and on this account we find the electric output too small to charge our patient sufficiently while the rod rests upon the surface of the platform. We can augment the charge by turning the plates faster to increase the flow, and, to prevent loss *en route* to the patient, we alter the method of connection to a direct metallic contact. To do this the patient may either hold the rod or chain in her hand, or place her foot upon a metal plate, or simply stand on the end of the chain attached to the machine. Either method will at once impart a vigorous increase to the electric charge, as none of the current is now wasted through poor conduction.

If for any reason we wish to reduce the energy of the charge, we reverse the preceding steps, slow down the machine, and remove the conducting rod to the distant corner of the platform. Thus all necessary modifications may readily be made, and the effect in practice corresponds to the action of a rheostat or current controller. What we have applied to the patient has, however, been in the nature of a continuous current; and, inasmuch as certain effects are dependent upon intermittent action and rate of electric change in the body, we will now treat our patient with an interrupted current. She is still seated as before, and continues to be electrified. We make no change in her relation to the machine, but we hold our ball electrode, attached by a chain to a gas fixture, near any part of the positive pole. If we hold it very near we get a rapid succession of exceedingly fine interruptions, every spark representing a complete break in the current. Between this near distance and the longest distance at which we can get a spark—say four or five inches*—we may obtain all the variations in interruption that can be produced by faradic vibrators. By sweeping the electrode past the pole, a single spark at a time will give us as slow an interruption as may be wished for special purposes. We may also adopt an entirely different method of interruption, and in certain cases we prefer to do so. The patient now holds the platform end of the conducting rod, while the machine end is not hooked upon the pole, but is rested against the case so that it drops a half inch or inch below the pole on its way to the patient. This results in breaking the continuity of the metallic conduction, gives us a stream of sparks, and interrupts the current either finely or coarsely, as we may desire, according to the length of spark drawn. If it requires additional intensity, we have only to attract the current out of the patient on the opposite side or above the head, or at any point where local effect is indicated. The force of the flow is instantly increased. These two methods are useful in many ways and will be studied in greater detail later on. In their various forms of applicability they constitute a method original with the author, and are an addition to previous methods employed. See description of potential alternation.

* Since employing larger machines the author uses a spark gap of six to ten inches

But our patient complains, for instance, of a severe nervous or congestive frontal headache, and requires something more localized than general electrification, which, however, does not stop, but goes right along with every after process, and contributes its quota of benefit to the entire sitting. We take up the point electrode, attach it to a chain, the distal end of which we may hook to the negative pole of the machine; or to a gas fixture, water pipe, or furnace register; or any metallic body which will conduct the discharge to earth. By now holding the electrode cautiously near the seat of pain, we apply to our patient the static breeze. Upon the bare forehead and throbbing temple it plays like a cool zephyr, bringing ease and relief at once in the great majority of cases, and removing pain in from five to fifteen minutes. It is the most exquisitely delightful of all electric applications, and is hardly surpassed in importance by static sparks. To obtain effects which are both pleasant and beneficial, however, a certain degree of care and experience is required, for, unless properly administered and with due regard to circumstances, the static breeze is liable to prove disappointing. It may even be made exceedingly disagreeable; nay, it may be intolerable in the hands of a careless bungler. A great part of the expressions of appreciation, pleasure, and satisfaction elicited from patients is due to the judicious use of the breeze electrodes. On this account we shall describe more fully certain features deemed of practical importance.

The most soothing application is the positive breeze.* With this the electrode may be held quite near any part of the body. The positive breeze may be applied to the head, spine, or any part of the body with very little fear of irritating the patient. Not so the negative breeze with positive insulation, attaching the electrode either to the negative pole or to the gas fixture. Upon the bare forehead it is prickling (and for many exceedingly unpleasant), if the electrode is held at a distance. To be agreeable it requires to be held almost as near as may be without drawing a spark, and two or three inches is my usual rule. A head breeze can be given in this way if the patient is bald, but if hair abounds upon the head, or if applied to any clothed surface, the electrode must not only be removed to a distance,—twelve to twenty inches or more,—but the breeze should be kept in gentle motion to avoid an annoying prickling in certain spots. The thickness and quantity of the hair may make it difficult to give this form of breeze from a stationary electrode, although the patient may sway the head from side to side to suit his or her sensations. Upon the head also, a lady's hairpins, if metallic, may play havoc with your efforts to please, and it is the writer's custom to substitute vulcanite hairpins before commencing treatment. Occasionally metallic ornaments about the neck will cause discomfort, and should be protected, removed, or avoided by the operator. About the spine and abdomen steel buckles, buttons, and corset ribs may be an interference with both breeze and sparks. In a general way it is also better to have a

* The sensory and therapeutic effects of any static breeze are governed by conditions under the control of the operator who must regulate dosage.

patient lay aside keys, watch, eyeglasses, etc., if local applications are to be made in their vicinity ; but in most cases the tact of the operator will sufficiently avoid these sources of discomfort ; and it is better, if possible, to request few changes in a patient's garments. It is rarely necessary, and the trouble of taking off her corsets for treatment will not increase the popularity of static electricity with a fashionably attired lady. But all our care in administering the breeze is not dependent upon hidden corset steels and metal hairpins. If the coat or dress waist be of silk or cotton fabric, the best effect is obtained with the electrode almost as near as the current strength permits without a spark, gently sweeping the electrode over the region treated and drawing it away with such manipulations as experience discovers to suit the particular case in hand. If, however, the fabric is of wool, the sensation produced may be unpleasant. If tightly woven and thick, the breeze will, perhaps, be scarcely felt, and must be applied correspondingly near. If the woolen garment be of loose texture, it may be difficult to find any distance at which the electrode may be held to make the negative breeze agreeable to the patient. Certain desired effects may, however, be had by rapidly sweeping the electrode to and fro, and the prickling may be modified in various ways, such as covering the part with a handkerchief or towel, diminishing the speed of the machine, or by leaking off part of the current supply. An exceedingly mild and exquisite breeze may be obtained, when exceptional conditions call for the utmost refinement in our measures, by simply holding a finely pointed electrode in the hand without grounding it in any other way. It should be grasped by the operator upon the metallic part without opposing any of the insulating rubber handle, and, when moved with gentle passes near the patient's head or spine, the breeze imparted is of the mildest nature.

At times the reverse is desired, and we wish to increase the intensity of the breeze. This may be done by quickening the machine, by having the patient in direct connection with the positive pole, by placing a layer of flannel cloth over the part, if it is covered with a less resisting substance ; but most of all, the activity and force of the breeze may be increased, while its irritation is often diminished, by interrupting the current by the author's method, as elsewhere described. On the whole the breeze application is susceptible of great variety, and if skillfully handled, with due tact and prudence, it will do more than any other form of electrical application to establish a large and gratified clientèle. If the physician who wishes to excel in technique will seat himself upon the platform and personally test the sensations which the spray electrode will produce under the different conditions we have referred to, it will be time well spent and money saved ; for a disagreeable shower of "pins and needles" may lose a new and nervous patient as readily as a luckless spark.

The static spark requires to be somewhat sparingly and prudently administered. Its redeeming feature, which alone preserves it from obloquy, is its tremendous power for good. If the suggestions here made are followed, it will be disarmed of its more serious drawbacks and will be a most potent

influence in contributing to the great sum of results attributable to static electricity. All cases do not require sparks, and when sparks are especially indicated, mild ones may often serve the purpose.

To apply sparks, we have the patient insulated as before and continuing to be electrified ; either positively or negatively, as the case may be. In our present illustration we have the positive pole attached to the platform. The spark is given with a spherical electrode usually, although any metallic electrode will give off some kind of a spark, if it is placed in a position to do so. The round extremity of the electrode may be of various sizes, and the thickness of the spark will be partly dependent upon the surface area of the ball. We take the largest one—say two inches and a half in diameter—attach it to the grounding gas fixture by the chain we have already used in employing the breeze electrode, and explain to our patient what is coming. Never apply a spark without first telling the patient to expect it. It is rarely advisable to administer sparks at a first sitting, if the patient is a stranger. After several treatments the system acquires a degree of tolerance, especially after confidence has been established by the tact and skill of the operator. If the patient is an acquaintance, a brief explanation may suffice to prepare him or her for any form of application that may be desired, but it is my custom to show all nervous patients who have never had sparks exactly what they are, tell them how they feel, and obtain their confidence before administering this treatment. I then slow down the machine, if necessary, leak off part of the current force with my foot against the platform, and deliver a single mild spark upon a part where it will be well borne, usually the fleshy part of the middle thigh or upon the spine. This done, the patient's uncertainty and dread is ended. She has felt just what the spark is, and seldom offers any further objection. Not always is the spark found to be disagreeable. A surprising number of patients will claim to really enjoy mild and skillfully directed sparks. Cases will be met in practice in which, indeed, the spark is the most welcome form of treatment. The torpid tissues of a paralytic limb may be so insensible to stimulation that the heaviest sparks that can be obtained from an ordinary machine are calmly witnessed by the patient, who regards the blows with manifest indifference ; and in morbid states of sluggish natures and lymphatic temperament, the sparks will seldom raise any objection.

If the long spark is discovered to be painful and exceedingly distressing, it is well to be very sure that it is indicated before giving it. It is generally found to be most bearable, most welcome, and most beneficial where it is most truly indicated ; and, on the contrary, it is least tolerable when least required, though there are exceptions to this rule. A toleration also is often speedily developed. Once across the Rubicon with a new patient, the strength and vigor of your sparks, which have always at first been mild, may be adjusted to fit the case, but let the accession of vigor be imparted gradually. Sparks should be no heavier than needed to do the work. They should first be tested in a mild form before resorting to the most powerful that can be given. They should be clean, thick, distinct, and single ; with both an

interval of time and a "change of base" between every one administered. A rapid fusillade of sparks is often unpleasant. A number upon the same spot is apt to create a tenderness. A long thin spark is usually stinging, while a thick one is less so. If the spark "splits" and gives off fragments, seek the cause and correct it, for such a spark produces an uncomfortable sensation. About the throat and various parts of the body it is often desirable to accurately localize the spark, while attracting promontories near by render this difficult to accomplish. A spark-director is made for such a purpose, but it is expensive. An insulating plate of vulcanite, or even of wood, pierced in the center for the passage of the spark, is also occasionally employed. These devices, however, are seldom an absolute necessity. There is scarcely a spot upon the exterior of the body where a spark may not be exactly placed by drawing aside the adjacent parts, slowing the machine, and sending the ordinary electrode to the spot with a quick, sharp stroke. A nearby prominent part may be protected also by laying over it a folded paper, or something to obstruct and lessen its attraction. Having a case for powerful sparks in hand, we may now increase the effect in several ways. Putting the machine into more rapid action is usually sufficient in favorable seasons. If more than this is required, we may again make direct metallic connection between the patient and the machine. The conducting rod or chain may be held in both hands or placed under both feet. Caution will be advisable if this is done, for the first result may surpass your expectations. If this proves less powerful than is desired, however, as may be the case in damp and summer weather, a pair of small Leyden jars may be brought into the circuit. Still greater caution should now be displayed, and the spark tested before applying to the patient. The smallest jars may be tolerated usually, but the larger jars overdo the matter, and the largest size should never be employed unless for good and well-understood reasons, and by an experienced physician, between whom and the patient there is entire confidence. The day of salivating doses of mercury is past; equivalent doses of sparks should be equally obsolete, and the promiscuous use of strong Leyden jar shocks belongs to the last century, when medicine went far to justify *Macbeth's* exclamation, "Throw physic to the dogs—I'll none of it."

Sparks may be administered, as may also the breeze, while the patient is electrified with either the positive or negative pole; and with the electrode attached to either pole, or to the ground. When we desire a muscular contraction, without the sting which is more or less inseparable from a spark directly upon the patient, the author's method of interrupting the current is of use. An example would be a case of lateral curvature of the spine, which usually occurs in young girls whose nervous condition presents objection to any form of treatment involving pain. The spine is bared sufficiently to apply an electrode directly upon the skin, and over, in turn, the motor points of the faulty muscles. The electrode is attached by a chain to one pole of the machine.* The other pole is grounded, and with a grounded ball electrode, sparks are slowly taken from the pole to which

* This is a local application of the "NEW INTERRUPTED STATIC CURRENT" originated by Dr. Monell in 1893.

the patient is connected. Another way—and one equally available—consists in holding a small ball electrode upon the spinal motor points while the machine is adjusted as in ordinary positive electrification. With a grounded ball electrode, sparks are then applied to the metal part of the electrode held in contact with the patient, but at a distance from the ball, which presses upon the motor point of the muscle. The contraction which follows is painless and effective. In this way an unlimited number of sparks may be applied to any given point without creating tenderness, as do repeated sparks upon a single place upon the body. Moreover, the strength and frequency can thus be so regulated as to produce effects reaching from slow, single, deep contractions to the infinitely rapid, sedative quality of the high-tension faradic coil.* If a spot upon which I wish to repeat heavy, direct sparks becomes painful, as for instance a ganglion or goiter, I first obtain a degree of local anæsthesia by this method of a high-tension application or by a sedative breeze, and then can follow with the sparks with no discomfort. In applying sparks upon the skin, it may be dried perfectly, if desired, by first dusting it with a little powder. The spark is then thicker, cleaner, and less sharp. Air spaces under folds in the apparel interfere with sparks and should be removed by drawing the garment to a smooth fit. Damp clothing will interfere also, and some fabrics facilitate the application more than others. A steel buckle, a bunch of keys, metal buttons, ribs, and steel springs in waists and corsets will attract the spark intensely and produce too sharp a sensation for comfort in some cases. In all static administrations there must be two objects kept in view. One is to produce benefit to the patient; the other is to avoid all possible annoyance. It is always desirable to strive to make the treatment as agreeable as possible, and this is generally as important a factor as the constitutional effect of the treatment, for the two results will proceed better in double harness than if the patient thinks the cure as bad as the disease.

Considered as a mere luxury and apart from remedial effects, no other form of medical treatment is capable of imparting the sense of satisfaction which can be obtained from certain forms of static electricity. Unless the effect of a counter-irritant is especially desired, the breeze should be as agreeable around the head and spine as the soothing manipulations of a dextrous hair-dresser. If sparks are applied with conservative caution until tolerance develops in the tissues, there will be very little complaint. Slowly repeated, clean-cut sparks will be readily endured even by hypersensitive neurasthenic cases. Never treat a new patient to a fusillade of sparks at a first sitting. A volley from a Gatling gun would be more fatal to life, but hardly more destructive to business.

There are certain anatomical localities which are usually to be avoided. In a general way the head should be omitted from spark treatment, though to this rule, as well as to most others, there are exceptions, and modified sparks are frequently applied to special portions of the head with great benefit. The breast, both in male and female, and particularly the nipple, is sensitive; in many cases extremely so, and should not be struck with

* This is a local application and variation of the NEW STATIC INTERRUPTED CURRENT originated and described by Dr. Monell in 1893.

a spark except for sufficient cause. Bony prominences throughout the body are regions where caution is advisable, there being no pillow of soft tissue to break the blow. A spark on the dorsal surface of the foot or hand, and especially over a toe or finger nail, is more uncomfortable than many patients would admire unless the conditions are altered by disease, as they would be in a case of chronic synovitis, or localized œdema. The genitals, most of all, must be avoided. The sickening sensation caused by a spark in this peculiarly sensitive region would have no other excuse than bungling carelessness.

Besides the ordinary and single, thick percussion spark, which has hitherto been the sole subject of our consideration, there is a form of "friction" spark which has certain uses. It may be obtained in several ways. The ball electrode may be enveloped in a flannel covering and rapidly rubbed over the surface, if applied directly to the skin. Upon the covered body the same effect is furnished by the resistance of the garments worn, especially if of wool. It is a near counterpart of general faradization, is quickly applied, and exceedingly valuable in myalgias and as a cutaneous stimulant. One of the most effective methods, also, and one often employed by the author, is secured by rapidly interrupting the current and using the spray electrode. The *technique* is as follows. Let the patient hold the conducting rod above or below the sliding positive pole of the machine so as to draw a series of rapid sparks of a length to suit the conditions of the case. The point electrode is then grounded or connected with the opposite pole, and rapidly swept over the affected part at the distance which is found to produce the proper effect. As the electrode approaches nearer the spine or limb to which it is applied, the breeze will merge into a brush discharge, and still nearer this will become filled with jets of fine, flying electrified particles of air; a veritable electric spray! Stronger sparks will occasionally be interspersed with the finer jets, if the electrode is swept still nearer, and the administration partakes of the nature of a powerful and stimulating tonic. Its intensity is, however, under complete control, and may be regulated to a proper degree.

The Massage Roller application is next to be described. There are two methods employed by the author. The roller electrode may be attached by chain to either a pole of the machine, or to the grounding gas fixture—the patient being electrified from the opposite pole. The sliding rods of the machine are first placed in contact and the roller applied upon the part to be treated. The strength of the current is increased by slightly drawing the poles apart while the electrode is kept in motion by rolling it up and down the affected limb. The strength of the application should never pass beyond the patient's comfort. A sense of heat accompanies the administration through ordinary apparel, and the necessity for rolling the electrode arises chiefly from this fact. The massage effect may also be applied by interrupting the current by the author's method.* The effect is similar, but is under better control of the operator, and if the electrode is attached to the ungrounded pole and used as the conductor to electrify the patient,

* Not only the roller but any other electrode used for labile or stabile faradization may be employed with this *Interrupted static current* as follows:—

all risk of burning sensation is avoided, and the interruptions may be made as rapid or as slow as desired : while the electrode may be applied without heed to its rapidity of movement ; which may be governed at will in employing this method.

Shocks.—At present *shocks*, as the term is now understood, bear a similar remote relationship to scientific electro-therapeutics that collisions bear to regular railway travel ; with the important exception that an engineer cannot always avoid a collision, while a careful electrician will very rarely give a patient a shock. In static application, however, the term is applied to the Leyden jar discharge, formerly employed to a considerable extent in the days of small and less powerful machines than we possess now.

It is not necessary to describe the method of giving them, as for all practical purposes they may be considered obsolete. They were relied upon in early days because a small machine would fill a Leyden jar while it would not supply a current flow sufficient for therapeutic use. The electricians of the eighteenth century were, however, close observers, and as early as 1781 Cavallo makes the following remarks : “ Formerly, in order to stimulate, or in general to apply electricity to any diseased part of the human body, strong shocks, or at least very pungent sparks, were thought necessary, but at present it is very reasonably established by experience that the greatest electric powers which can be applied with good expectations are exceedingly small shocks and moderate sparks, but that in general the most proper treatment is to throw the fluid by means of a wooden or metallic point, in which last case the person electrified feels only a gentle wind upon that part of the body toward which the point is directed.”

Static Induced Currents.—By means of condensers and transformers various modifications of electric currents are produced both in commercial and medical fields.

Two notable alterations of the static current are now obtained by transforming devices. One of them is recent and produces the effects of high frequency, high potential currents, sinusoïdal in character, and not yet sufficiently familiar to the profession to warrant more than passing reference here. (1894.)

The other is obtained from simple Leyden jars, and is the well-known static induced current. Briefly stated, a Leyden jar is attached to each prime conductor of the static machine. Small jars are generally used and impart an effect similar to a fine wire-coil. Larger jars are allied to short, coarse-coil currents. To the outer coatings of these jars are attached a pair of ordinary conducting cords with moistened electrodes. The poles of the machine, having previously been short-circuited, are now separated very slightly, giving a short spark. During the passage of each spark an induction current is sent down the cords and received by the patient, who is not insulated. A slow revolution of the machine causes sparks to pass slowly, and, if the electrodes are applied to muscles, will set up slow contractions,

which are marked by great energy. The poles may be sufficiently separated to obtain the desired dose, but will exceed tolerance if too long a spark is passed. A range of one-half to two inches covers about the current strengths employed. When the plates are more rapidly revolved, the effect varies exactly as faradic currents vary with the rate of interruption.

Rapid revolutions and a rapid stream of sparks produce a high-tension current, which may be increased or diminished in strength according to the distance between the poles. A chapter might be devoted to this current alone, if its various uses were described, but as it would chiefly repeat all that may be said of the application of all other induction currents, a full account would be superfluous. Suffice it to say that it is employed precisely as faradic coil currents are applied, and not only may duplicate in the hands of an expert every application customary with faradism, but goes beyond the latter in some of its effects. The portability of the one and the cumbersome of the other apparatus, as well as the independence of coil currents to atmospheric influences, prevent, of course, the entire substitution of the static machine for both faradic and sinusoidal apparatus, notwithstanding that, so far as mere ability to obtain effects is concerned, the static covers about the same range as the other two.

It now remains to discuss *Potential Alternation*, the author's method of *interrupting the ordinary static current*. A description of this method was first published in the *Times and Register*, September 9, 1893, under the title of "**A New Static Interrupted Current; a New System of Therapeutic Administration of Static Electricity Based upon the Principle of Potential Alternation.**"

From this article the following extracts may be quoted :

"I have for some time employed with satisfaction to my patients and myself a new method of applying static electricity, of which I have seen no account hitherto published. It is my purpose to lay before the profession the results obtained by this method.

"In the general tonic method which I shall now describe no change is made in the adjustment of the machine or in the patient's clothing. The patient is seated upon the platform, and after being charged in the usual manner, his potential is suddenly reduced to zero by the approximation of an interrupter to the conducting rod. A succession of alternations between a high and zero potential may now be maintained as rapidly or slowly as desired.

"The interruptions may be regulated at will from one in any number of seconds to any number per second, and by fixing the interrupter on a standard the application becomes automatic and does not require the operator's constant attention.

"In my hands the variations of this method serve me as an agreeable substitute for the static spark. Remarkable as it appears, the more or less disagreeable and often painful, and to some intolerable, spark has been for more than a hundred years the main therapeutic reliance in the static treatment. Many a patient has been lost by the incautious use of sparks on a first visit. It was the desire to avoid the disagreeable features of the spark application that led me to develop my new system of *interrupted static current*. It is painless, simple, and effective. As a general nutritional treatment it leaves little to be desired that could be obtained by sparks. By the application of conductors I *localize* it to any part as large or small as I wish, and by local methods it resembles high potential faradization. By slowly repeated powerful interruptions the effect is made exceedingly stimulating, while the more rapid the interruptions the finer and more sedative the effect. It can also be made to produce a most exquisite, yet easily borne, counter-irritation. I find it to answer well for certain general and many of the special and local indications for sparks, while it seems to lack

little of their peculiar power to rapidly remove localized pains deep-seated in fibrous tissue. I have tested it in many ways, and the possibilities of its successful application grow apace with experience and ingenuity in using it. It does not altogether enable me to avoid the use of sparks; but a comfortable method which will produce identical results, in many of the cases to which the spark is applied, cannot fail to be a source of relief and gratification to both physician and patient. Whatever of therapeutic value is imparted to galvanic and faradic currents by "interruption" must also be imparted to the static current; and the speed of the interruption of the static current can, by my method, be made to cover a greater range than any faradic vibrator yet invented. When administered merely for its general nutritional effect, it is exceedingly suggestive to note the visible oscillations of the patient's hair, to feel the vibratory commotion in the surrounding atmosphere, and to consider the molecular disturbance and alteration of nutrition which must be going on in every part of the electrified body, since the potential inside a conductor has the same value as at any point on the surface.

"And this alternative commotion among the tissue cells, quickening the protoplasmic activity, is carried on so mildly that the patient is conscious only of the gentle breeze. As regards local applications to give muscles work and stimulate contractions, I have found my method of practical service, and this too on certain days when, from atmospheric conditions, no spark could be drawn through the patient's clothing. Patients coming in with damp garments on rainy days have been successfully treated when, had I depended on sparks, I should have been left without resource. In order to estimate the relative value of an interrupted current and vibrating potential as a therapeutic application of static electricity, we have only to compare it with the three classical methods in general use—insulation, breeze, and sparks—and with the so-called induced current. As to insulation, my method incorporates it, but attacks its constant potential by means of the interrupter and imparts to it a succession of stimuli which must inevitably quicken functional activity. **Sufficient comparison with sparks has already been made. It nearly approximates the local action of the Leyden jar current, but adds to it the general tonic action of an interrupted electrification.**

"The experience of a century has given us no other general method. It is evident, therefore, from a mere glance at the extremely limited variety of static applications and the limitations of each, that a new method of practical simplicity and extensive therapeutic range is a desirable contribution to static treatment. It can be applied to the whole or any part of the body, and employs electrodes as simple as those in common use. **A careful review of such records as have been available does not disclose any reference to any similar system of applying static electricity, and it may be properly claimed that this method is original with me.**" (See also pages 26, 27, 28.)

While a number of ingenious devices might be contrived to employ in the use of this method, it will usually be sufficient to utilize the ball, point, and roller electrodes. These, with the rod, a chain, a foot plate, and a standard, will enable the operator to obtain about all the effects he may desire. The ball electrode is used as an interrupter, drawing sparks from the prime conductor instead of from the patient. If the roller is attached by a chain to the machine, it may be applied by the operator to any or all muscles in turn, and rapid or slow, mild or very powerful, but painless contractions may be set up. If the patient's feet are placed on a metal plate or in a foot bath and metallic contact made with the machine, a negative breeze electrode placed at a proper distance above the head, while the ball electrode, grounded and fixed on the standard, is adjusted so as to draw a succession of long sparks from the positive prime conductor, a tonic and alternative effect upon circulation and nutrition will be obtained that is exceedingly beneficial in cases of disturbed equilibrium of the vital functions. As a means of giving exercise to the arms there is no other method superior to potential alternation.

Simply wind the chain around the forearm (bare) or apply a local electrode and proceed to interrupt the current. Every muscle will be brought into play, more or less, according to situation of the contact. If held in the hand, or if the hand is immersed in a bath, an effect extending up the entire arm may be produced. I have noted in cases I have exercised in this manner that the muscles not only become firm and play under the skin with remarkable facility, but that the skin itself becomes tanned as if from exposure to outdoor sun and air. I have never seen this effect produced by direct sparks upon the person, but have witnessed it repeatedly in cases treated by potential alternation. The pallor of persons confined to the house by protracted illness is thus removed very rapidly and replaced by a healthy color, even though they continue to remain indoors.

Much more could be written upon this subject, but no treatise, however complete, can take the place of experience. In order to operate a static machine with satisfaction and with good results, it is necessary that the physician should not only acquire facility in the technique of handling the machine, but he must also know how to inspire confidence in the patient, and at all times exercise the care and minute attention to the details of his treatment that are essential to success in all forms of electro-therapy.

In static applications there are but two chief forms of the kinetic energy to consider. One is the direct flow along the prime conductors; the other is the flow through Leyden jar condensers. It will be noted that my system *involves all methods of interrupting the direct static current*. In my method the manner of the interruption is immaterial as relates to the principle of action, and is important only as it modifies the effect. For instance, the interruption is made in local uses with the sliding poles the same as is now done in the case of Leyden jar currents, but I do not recommend this manner in *general* electrification for the reason that the control of the rate of interruption as well as of the dose is far less satisfactory than when the electrode is used, as I have preferably described. Moreover, as demonstrations of the high potential energy of either interrupted static current a perceptible effect may be obtained from the application of a single electrode whether the second pole is grounded or included in the circuit or not; but to obtain full therapeutic usefulness it will be well to adhere closely to the methods recognized as most effective in actual practice.

In carelessly or ignorantly employing galvanic or even in some degree faradic currents, there is a well-known possibility of doing harm. This liability is reduced to a minimum in the case of static applications; nevertheless, a patient may be startled by careless sparks or any accidental derangement of the administration. In avoiding needless causes of alarm to the patient the physician will do much to build up his success with static electricity.

Note.—The Monell "INTERRUPTED STATIC CURRENT" employed with the patient on the insulating platform connected by a local electrode or general contact with a single pole of the static machine, while the opposite

pole is grounded, constitutes a therapeutic resource as distinctive in type, as various in methods of application, and about as valuable as any other single intermittent current, whether derived from faradic coils, a sinusoidal apparatus or from the static machine itself through Leyden jar condensers. Since originally described by me it has been in use now nearly seven years. Others have employed it from my writings and accord it high praise. Its *local* uses cover most of the ordinary uses of coil currents, with the advantage of the systemic effects of the electrification of the entire body. Its *general* application has for years constituted my chief tonic method in private practice. Its local applications coincide with the indications for Leyden jar currents, but there is this difference between these two kinetic forms of interrupted static electricity; in the case of Leyden jar currents the *accumulation* takes place in the jars, and the course of the current in the uninsulated patient is the local path between two electrodes; in the system of interrupted static current originated and described by me in 1893, the accumulation, without which no treatment of patients with static electricity is possible, takes place as usual on the insulating platform, and the whole body of the patient benefits by the complete "charge" or electrification which the method involves. It thus adds a *general* effect to every *local* effect, something which no other kind of intermittent current locally applied accomplishes for the patient. Prior to my publication of September 9th, 1893, in the *Medical Times and Register*, I had employed this interrupted direct static current locally in sprains, writer's cramp, neuritis, circumscribed burns, paralysis, rheumatism, arthritis of small joints, pain of various kinds, and numerous other conditions. I had used the several static electrodes, tin foil, pliable sheet tin, sponge-covered faradic electrodes, chain, water in localizing vessels, etc., as means of contact for the parts treated, connecting the same to either positive or negative prime conductor with the patient insulated and the opposite pole grounded. Local applications require exposing the surface of the skin the same as Leyden jar and coil currents. Having subjected the current to every practical clinical test during about seven years, it is gratifying to find its value being recognized by others who have adopted its use from my teachings and writings. The name "potential alternation," which I first employed to express the actual rise and fall of the patient's electric potential has become widely identified with my *general tonic* use of this static interrupted current, but many have overlooked the important *local* uses of the same current referred to in my original article. I therefore again direct attention to "A New Static Interrupted Current; a New System of Therapeutic Administration of Static Electricity," with special reference to its *LOCAL* applications, which may be made of great utility in a considerable number of cases. It is easily employed. My early estimate of its value has been confirmed by the testimony of others. It is susceptible of exact dose regulation. In using it locally and regulating the current strength by means of the spark gap between the sliding poles, I have devised an adjustment for a "sound deadener" drum which reduces to a minimum the noise of the stream of sparks, and which can be instantly put on the poles and removed by pressing a spring. This is a convenient device for every owner of a static machine to possess.

S. H. MONELL, M. D.

New York, January 4th, 1900.

A DESCRIPTION OF THE EFFECTS PECULIAR TO SOME OF THE DIFFERENT METHODS OF APPLYING STATIC ELECTRICITY.

HAVING explained in a preceding paper the several methods of administering static currents, it may be interesting to observe the peculiar differences ascribed to certain forms of discharge and to outline some of the general indications for treatment of clinical cases.

Static Electrification.—This has variously been termed insulation, the static bath, etc. But the term I here adopt seems more appropriate. It is a mild but efficient tonic, having somewhat the twofold action common to all forms of electricity according to whether the positive or negative pole is actively employed. When applied with the positive pole, it is a refreshing, grateful, and most agreeable tonic in all debilitated or negative states of the system—those neurasthenic, anæmic, malarious, cachectic conditions in which the patient is “below par.” For the after-effects of the “grip,” for brain fog in professional men, for physical, mental, or nervous exhaustion it is in the nature of a specific. The mildness of the treatment by the positive static charge, its facility of administration, its wellnigh universal applicability to every age and to every possible condition of disease, attach to it a peculiar importance which is worthy of our fullest consideration. It is in fact an artificial positive electrification of the atmosphere.

No one can doubt that the natural electrical conditions of the air we breathe influence health. Scientists assert that all atmospheric states which have been observed to have an unfavorable influence upon health are accompanied by an increase of negative electricity in the air. It is well known that before a thunder-storm an indescribable sense of malaise and oppression is felt by many individuals, and especially by those of a delicate nervous temperament or subject to rheumatism, neuralgia, etc. At such a time the atmosphere in the neighborhood of the earth is surcharged negatively, and the common expression that a thunder-storm clears the air is scientifically correct: the equilibrium of the two forces of electricity being restored by the exchange in the visible form of lightning between the lower negative and the upper positive layers of air. The state of the electrification of human beings in normal health is almost invariably found to be positive. Many of the good results derived from static electricity during its flourishing period in the eighteenth century, when it seemed to perform the most miraculous cures, probably were due as much to the positive electrification as to the now obsolete “shocks,” which were then deemed necessary, since Ramsden’s machine, which was introduced in 1760, and for long afterward was in common use, would administer only a positive charge when applied in the ordinary way. The positive charge is therefore of primary significance in general debilitated conditions from infancy to old age, whether the result of exhausting illness or drain upon the system, or overwork, anxiety, excessive lactation, suppuration, impaired nutrition, social dissipation, functional de-

rangements, or mental states such as hysteria, melancholia, hypochondriasis, nervous insomnia, etc. In regard to its influence upon malaria, Dr. Maddock observes:

"In my experience I know of no more valuable feature of static electricity than its power to help eliminate malarious conditions from the system. It has been universally admitted by scientists that in malarial districts the air is electrified negatively. Following out this thought, I reasoned that owing to the greater conductivity of the air, due to moisture, people residing in paludal districts were deprived of an adequate supply of positive electricity. Acting upon this, I have for years employed the static machine by positive insulation in every case of suspected malarial origin, and the results have surprised myself. At times, before I obtained my present machine, I was, owing to atmospheric influences rendering the generation of electricity in any sufficient quantity impossible, tempted to abandon this form of treatment, but in over a year and a half I have never been disappointed in getting quantity and quality to meet all demands."

When a person is simply "run down," "overworked," and "fagged completely out," but unable to leave business and seek a change of climate, our daily experience confirms the belief that the alterative and stimulating effect of electrification embodies the potential benefit of a climatic change, sea-voyage, and rest; and it may be remarked that the atmosphere surrounding a patient seated upon the insulating platform of a static machine is richly charged with ozone, which the electrical action rapidly generates, and which, inhaled by the patient during treatment, no doubt contributes to the beneficial results.

Negative electrification, applied in the same manner, but from the negative pole, has been variously esteemed by different writers. It is undoubtedly less energetic than the positive pole. It has been held to be a sedative tonic by some, and by others a depressant.*

There are several points of difference between its action and the sensations and effects produced by the positive charge, but these need not be minutely considered here, as each operator can determine them by a personal experience. The writer is not prepared to accept the statement, made by an English author, that the negative charge "produces a condition of utter prostration, similar to that produced by blood-letting." I am in the habit of using it as a sedative in nervous excitability and overactive conditions of the system, and particularly in conjunction with the positive breeze or spray, the combination of the two resulting in the most sedative application that can be administered from the static machine.

It was held by Koestlin that continued negative electrization retarded both animal and vegetable life.

While yet awaiting a full analysis of the actual differences between the effects of the opposite poles in general electrization, we may reasonably conclude that the therapeutic selection in a given case may be of primary importance. This is much more so, since the principle of "localized electrization," as established by Duchenne, who sought to cure disease by local treatment, has had an overshadowing influence upon electrotherapeutics since his day; but while not ignoring the value of the local method, and utilizing to the fullest extent the advantages of its specific application, the

* All effects of static electricity are what the operator makes them by regulating the dose and action.

static method goes further, and has for its basic principle a general constitutional influence, upon which the local effect is simply grafted. The entire administration of static electricity is first, last, and all the time a general systemic impression upon the entire organism, the vital functions, and excretions, furnishing during every form of treatment an elementary and continuous impression upon the nutrition of the individual, which seeks to promote the highest degree of constitutional vitality and to increase the tissue-resistance against disease germs and unhealthy surroundings. This grand foundation benefit is inseparable from the therapeutics of static electricity, and therefore underlies the application of every form of local treatment, and may be considered as adding to the importance of a proper selection of the initial charge which is administered to the patient. While not intending to carry the idea too far, the writer ventures the suggestion that the considerations which determine the selection of a suitable climate, for certain classes of cases, may often properly influence the choice of the static pole. That we are every day bathed in an atmospheric electric bath, is scientifically established. Prof. Elihu Thompson demonstrates that as we rise from the earth's surface to different altitudes there appears to be a gradual increase of potential with respect to the ground, so that at one thousand feet there may be ten thousand volts' difference between the air at the top and at the surface; and this difference may increase as we reach higher altitudes.

In low, damp, malarial regions it is found that the atmosphere is electrified negatively, while the higher we go the more positive does the atmosphere become. Dry, clear, cool, sunny, rarefied, high (positive) altitudes are recognized as a stimulating combination of climatic attributes which we would select for a large class of invalids, including those of phthisical tendencies, and as a tonic and restorative for persons suffering from overwork in business or professional pursuits, and who have no real organic disease. Accordingly, we should select also for these patients the positive pole for general static treatment, save when exceptional indications suggest otherwise. On the contrary, a humid, equable, warm, cloudy sea-level, and sedative climate, or again the calm, sedative, yet tonic atmosphere of the pine woods, would be selected for other cases, and especially in certain hyper-excitabile states of the nervous system. Here we might administer negative electrification. There is another not unimportant thought in connection with this idea, which relates not so much to the character of a climate as the influence and effect of a *change* of climate; and, to a certain extent, this can be effected by static (positive or negative) electrification. Though we can scarcely affirm that a change of climate is a specific remedy for any disease, yet the benefit which it frequently produces, in assisting the reparative powers of nature, is a matter of world-wide observation. Change of climate, however, is an exceedingly relative phrase, and need not necessarily involve an expensive and difficult journey, with the deprivation of accustomed comforts and a residence among entire strangers. Dr. E. I. Sparks well says "that a few-mile journey from the town to the country, from inland to the seashore, from the plain to the mountain, often suffices to

produce marked results." But while it is impossible for every one to travel in search of health, we have a means in the static machine of providing something of that element of contrast in the daily electrical and atmospheric environment of the individual which is the great incentive to a journey.

The *static breeze* reverses the order of the preceding. The positive breeze is bland, sedative, and agreeable; while the negative breeze is sharp, stimulating, and may be made irritant. The fact that the sedative negative electrification is employed in administering the positive breeze accounts, perhaps, for its soft and soothing qualities. Both forms of breeze are analgesic and will relieve many varieties of pain. The positive is peculiarly grateful and effective in neuralgias, in local inflammatory lesions, in congestive and nervous headaches, nervous insomnia, and irritability. It will rapidly remove almost any pain not due to structural change, and I have found it equally efficacious for a toothache and an aching bunion.

The grounded electrode with positive electrification also yields a remarkably useful breeze, and one which will answer for many purposes. The breeze (a convective discharge) will not produce a muscular contraction, while the spark (a disruptive discharge) will; hence nothing can take the place of some form of spark in affecting muscle function, promoting absorption, etc.; but I have occasionally removed very severe sciatic pains with the breeze alone, and if applied in its irritant form, like a hot spray, it is effective in muscular rheumatism and conditions requiring a powerful rubefacient and counter-irritant. Thus it is a superb cutaneous stimulant, will rapidly draw out rheumatic pains, ease a lame back, warm cold extremities, quiet a grumbling ovary, relieve the pains of a congested liver, remove nausea from a dyspeptic stomach. It imparts a long-lasting, buoyant glow to the spine, is a most exhilarating tonic, reddens the skin, and leaves a sensation of lightness and warmth behind. *

The opposite of this, viz., a positive breeze, upon a bare surface is cool, comforting to heated states, has no rubefacient or irritating effects, and is particularly tranquillizing upon the head and spine.

The Static Spark.—This, the most energetic of the various forms of electrical discharge, is also the most powerful therapeutic application of static electricity. It excites strong muscular contractions and produces a widespread mechanical disturbance in the tissues to which it is applied, causing active molecular change and exerting an extensive influence upon both local and general nutrition. The short, fine friction sparks, obtained by simply rubbing the ball electrode over the surface of the patient in contact with the ordinary garments worn, are indicated chiefly in cases of altered peripheral sensations, anæsthesias, myalgias, etc., but this stimulation of the terminal nerve filaments is carried to the central cells and produces deep and lasting effects. Frictions can thus produce rapidly, in a few moments of application to the entire body, and without removing any clothes, an effect very similar to that of general faradization. and I am accustomed to substitute static frictions as above for the more troublesome and less effective method, which I have never found occasion to use. It is, however, the long and

* These effects depend on conditions under control of the operator as taught by me.

strong, thick spark which is the most effective weapon in skilful hands. Its range of action is wide, and if carefully employed in varying degrees of strength its power for good may be called into requisition in the majority of cases demanding static treatment. It is this spark which restores tonicity to enfeebled or paralyzed muscles, softens indurations, resolves exudations, breaks down adhesions, and promotes absorption; stimulates nutrition and the functions of the central nerve cells; drives out hysteria, banishes rheumatism, gout, and malaria from the system; conquers sciatica and neuralgias of almost every form; relaxes contracted muscles and tendons, and subdues some of the most furious pains. It is the great alterative and regulator of nerve and muscle function and the functions of the visceral organs.

In chlorosis, chorea, amenorrhœa, and anæmia it rapidly restores the balance of health when other means have failed. It is the sheet anchor in chorea, as it is in sciatica and paralysis.

It is a valuable adjunct to the galvanic treatment of fibroids, immensely assisting in the relief of associated symptoms and in the contraction and absorption of the tumor.

It is the form of static electricity to employ in cases of goitre, ganglion, bruises, œdema, sprains, muscular deformities, spasmodic disorders, hysteria, aphonia, melancholia, hypochondriasis, and all debilitated states of the mind and body.

It is the tonic *par excellence*, deep-acting and far-reaching in its effects. It requires, however, to be employed with discretion and with a reasonable degree of tact and skill.

It may not be necessary to offer therapeutic suggestions to those who are familiar in practice with the several forms of electrical currents; but to others not familiar with the limitations of electrotherapeutics it may be opportune to state at this point that collateral aids to treatment from the various resources of the materia medica are always to be considered, and, when indicated, should be employed. The electrotherapist, in common with all other physicians, will use all means at his command which he thinks will cure.

A BRIEF SYNOPSIS OF THE THERAPEUTICS OF STATIC ELECTRICITY.

WITH a view to present the recognized indications for static electricity in a form appropriate for ready reference, the following paper is submitted by the author. To those already familiar with the well-known properties of the galvanic and faradic currents, the tabulated statement herein offered will furnish a convenient means of comparison. No attempt will be made to specify the various methods of administration, it being assumed that the reader is acquainted with the technique of operating the static machine. The writer's system of interrupting the static current has been described in other articles, and to them the reader is referred. The sphere of therapeutic action of static electricity is sufficiently wide to be justly considered remarkable without proclaiming it a cure-all. In many acute inflammatory states there are other agents which will generally be called into use; yet even here there is some work which "static" can well do. Its chief field, however, is found in conditions, either acute or chronic, which have to do with nerve action, muscles and joints, pain, functional processes, and nutrition.

(a) It affords the most certain permanent relief for lumbago, sciatica, rheumatic and muscular pains.

(b) Neuralgias of every kind seem to yield to it more speedily and permanently than to any other form of treatment. In the various types of head pains and in insomnia it is peculiarly efficacious.

(c) No other agent equals static electricity in combating hysterical states and associated conditions. It furnishes our best method of treating functional nervous diseases.

(d) It is an efficient regulator of deficient bodily functions, and is not surpassed by any other agent in the successful treatment of that important class of ailments known as functional diseases.

(e) As a general tonic, and as a stimulant to depressed nervous functions, it is of the utmost service, especially in neurasthenia and in old cachexias. As a means of improving the general nervous tone of patients it is without a rival.

(f) Reflex irritation, peripheral neuroses, etc., yield in most cases to proper applications of this agent. Pruritus of various forms, the itching of eczema, etc., are cases in point.

(g) In all dietetic diseases it acts with decided benefit; it produces remarkable improvement in disturbed visceral functions, nausea, vertigo, dyspepsia, constipation, colic, etc. In chlorosis and anæmia and all perversions of nutritive processes it lends ready aid to the restoration of the normal functions.

(h) Diseases of the scalp. Patients undergoing several months of regular static treatment usually find that their hair ceases to fall out in combing, and that the nutrition of the scalp improves.

* Physicians will find very full directions for treatment in Dr. Monell's 'Manual of Static Electricity in X Ray and Therapeutic Uses,' or 'The Treatment of Disease by Electric Currents.' The latter covers the field of all three currents, static, galvanic and faradic.

(i) Exudations, infiltrations, localized œdemas, etc., are quickly resolved and absorbed under skilful static administration.

(j) It usually surpasses all other forms of electricity in dealing with stiffened, contracted, or paralytic muscles, acute or chronic muscular deformities, and muscular spasm. The ease with which it will often conquer an obstinate case is one of the most surprising things in electrotherapeutics. Acute examples of these types not infrequently succumb to one or two séances of static electricity.

(k) Its tonic action makes it a valuable agent in diseases of the heart, both functional and organic. Where coldness of the extremities or general want of vital warmth exists, it possesses a singular power to promote the creation and distribution of animal heat.

(l) In locomotor ataxia it will do more to relieve pain and maintain a degree of comfort than any other agent. Used in conjunction with galvanism, it may arrest the progress of early cases indefinitely.

(m) It has given the most brilliant results in the treatment of hemiplegic, traumatic, and all forms of motor paralysis, and frequently restores complete muscular power after all other measures fail. Paralysis of the sphincters, of the vocal apparatus, or of any part of the body may be treated with better success by static than by other measures.

(n) It admittedly holds the highest place in the treatment of chorea.

(o) In epilepsy it produces excellent results in improving the general condition and in moderating the frequency and the severity of the attacks.

(p) In mental disturbances it should be faithfully tried whenever possible.

(q) Disorders of sensation are more rapidly improved by static electricity than by either galvanic or faradic applications.

(r) In exophthalmic goitre it affords relief to some of the most distressing symptoms.

(s) In gout and rheumatism its efficiency has been reputed great since the earliest history of frictional machines, even in rheumatoid arthritis it has won praises.

(t) It is a powerful, painless, and effective tonic to the weakened muscles in lateral curvature of the spine, as a "massage" it is unequalled.

(u) In the treatment of chronic inflammatory and spasmodic diseases—such as influenza, phthisis, bronchitis, unresolved pneumonia, asthma, laryngitis, neuritis, synovitis, etc.—it gives excellent and often brilliant results.

(v) In dermatoses, especially those dependent for their origin upon neurotic or nutritional disturbances, it is either an all-sufficient remedy or a valuable adjunct to medicinal measures.

(w) In gynecology the static machine furnishes most valuable auxiliary aid to galvanism, and single-handed will conquer a large percentage of woman's troubles.

(x) In convalescence from acute disease, debilitating fevers, and in all the tedious, irksome conditions of a slow recovery from an exhausting illness, the tonic and vitalizing action of static electricity excels any other agent in the author's experience.

(y) It is an invaluable tonic for the general infirmities of old age. Its constitutional effects increase the sum of vitality, and it will do much to relieve the distressing symptoms which render declining years a burden and a care.

(z) No other electrical application may be made so gratifying to the patient; no other method of treatment elicits such frequent expressions of satisfaction; no remedy may be more swift and permanent in action; none may be more easily applied in many cases.

This list does not exhaust its powers of usefulness, but will point the way to its application in various obscure conditions where diagnosis is difficult and where past treatment has yielded poor results. In these anomalous cases great aid may not infrequently be obtained from skilfully directed static electricity. Nearly every possible application of faradism can be duplicated with "static," and the full limit of its many-sided capabilities probably lies far beyond our present knowledge and experience. That it can promptly remove all pain and soreness from a superficial burn I recently demonstrated to the satisfaction of a careless assistant who had come in too close contact with a gas-heater in my office. Its control over nerve and muscle functions borders upon the phenomenal. Considered from every standpoint, a successfully operated and powerful static machine is, without doubt, the most surprising single therapeutic weapon in the whole arsenal of scientific medicine.*

* From the *New York Medical Journal*, January 20, 1894.



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"To the average medical man this volume will prove a revelation of a most remarkable kind. While all have a general knowledge of the fact that electricity can be used to great advantage in some diseases, but few are aware of the vast scope of usefulness it can subserve. We could not in the short space allotted us for this review give a tithe of the names of complaints benefited by this mode of treatment according to the author. His enthusiasm, too, is contagious, for as the reader proceeds he is unconsciously carried away into believing without seeing. He is a clear, forceful writer, and puts his subject before the reader in a way that cannot be misunderstood. His directions are all examples of perfect lucidity and just such as the practitioner needs when beginning the study of so fascinating a subject. The work of a good static machine and of a family battery is absolutely as incomparable as the medical advice of an Olser with that of a savage. This book should be in the hands of every person interested in electro-therapeutics."—*American Medico-Surgical Bulletin*.

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"It would be impossible for us to specialize the headings of the seventy chapters in this volume in the space allotted for this review, therefore it must suffice to state that every known modern employment for faradic, galvanic, and static electricity, and their therapeutic indications, are detailed in this volume with *conciseness of language* and *minute directions of application* so that the general practitioner who runs may read and understand.

"Probably no book on electro-therapeutics—and we say it conservatively—has ever equalled this volume for value to those of the profession who would use electricity as a therapeutic agent, and he who does not use it at this age is certainly not up to the times in his profession.

"We therefore heartily recommend this volume to our readers, believing that they will not be disappointed in adding it to their libraries."—*Medical Times and Register*.

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"Dr. Monell, the author of this work, is an inveterate worker and prolific writer. It is only a few months ago that it was our privilege to receive his large work on 'Static Electricity in X-Ray and Therapeutic Uses.'

"One cannot in a brief review more than hint at the scope of the work, so numerous are the points discussed. The indications for the use of the various currents of electricity and the results that can be obtained have now reached such a condition of exactness that we must now regard this means of treatment as having wider application than any other.

"When one sees how much can be written on a single therapeutic agent like electricity, it excites wonder to know why it is not more generally used by practitioners generally. Readers of this book may become versed in all the technical uses of this potent remedy and cannot fail to catch the enthusiasm which characterizes this author's work."—*Canada Medical Record*.

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